
XI. *Some Observations on the natural Family of Plants called*
COMPOSITÆ. *By Robert Brown, Esq. F.R.S. Libr. L.S.*

Read Feb. 6 and 20, 1816.

THE class *Syngenesia* of the Linnean artificial system, as at present limited, constitutes a family strictly natural, and by far the most extensive in the vegetable kingdom. It is also, with the exception of Grasses only, the most generally diffused, and is almost equally remarkable with that order, for the great apparent uniformity in the structure of its essential parts of fructification.

This class of plants, for which I retain the established name COMPOSITÆ, in preference to any of those recently proposed, has lately become the subject of a minute and accurate examination by Mons. Henri Cassini; two of whose Memoirs on the Style and Stamina of the class, already published in the *Journal de Physique**, are in my opinion models for botanical investigation.

A few years before the publication of M. Cassini's Memoirs on Compositæ I was induced to examine a considerable part of this extensive family, chiefly with a view to the more accurate determination of the New Holland plants belonging to it.

My principal object in the present paper is to communicate such general observations, the results of this investigation, as either have not yet been published by M. Cassini, or respecting which I consider myself to have anticipated that author in my General Remarks

* Of 1813 and 1814.

on the Botany of New Holland, appended to Captain Flinders's Voyage to Terra Australis.

To these observations I shall add some remarks on certain genera of Compositæ, which occur repeatedly under different names in late systematic works, and whose structure and limits appear to be imperfectly understood.

My *first* observation relates to the peculiar disposition of the nerves or vessels of the corolla of this family of plants.

In the essay already mentioned, which appeared early in the summer of 1814, I have noticed this peculiarity in the following terms :

“The whole of Compositæ agree in two remarkable points of structure of their corolla ; which, taken together at least, materially assist in determining the limits of the class. The first of these is its valvular æstivation ; this however it has in common with several other families. The second I believe to be peculiar to the class, and hitherto unnoticed. It consists in the disposition of its fasciculi of vessels or nerves ; these, which at their origin are generally equal in number to the divisions of the corolla, instead of being placed opposite to these divisions, and passing through their axes as in other plants, alternate with them ; each of the vessels at the top of the tube dividing into two equal branches, running parallel to and near the margins of the corresponding lacinia, within whose apices they unite. These, as they exist in the whole class and are in great part of it the only vessels observable, may be called primary. In several genera, however, other vessels occur, alternating with the primary, and occupying the axes of the lacinia : in some cases these secondary vessels being most distinctly visible in the lacinia, and becoming gradually fainter as they descend the tube, might be regarded as recurrent ; originating from the united apices of the primary
branches ;

branches ; but in other cases, where they are equally distinct at the base of the tube, this supposition cannot be admitted. A monopetalous corolla not splitting at the base is necessarily connected with this structure, which seems also peculiarly well adapted to the dense inflorescence of *Compositæ* ; the vessels of the corolla and stamina being united and so disposed as to be least liable to suffer by pressure."

At the date of this publication I certainly had no knowledge of any similar observations having been previously made: but I now see in M. Cuvier's account of the proceedings of the Institute of France for 1815, that M. Cassini is considered as having anticipated me on this subject, and as he says in " termes non équivoques." What these terms are, appears by a letter I have received from M. Cassini himself, in which he states his claim to rest on the following passage :

" Chaque fleur hermaphrodite ou male contient cinq étamines, correspondant aux cinq nervures de la Corolle et *par conséquent* alternes avec ses lobes."

This passage occurs in a Memoir on the Stamina of *Compositæ*, which was read to the Institute of France in July 1813, and first appeared with the substance of that Memoir in the *Journal de Physique*, said to be for April 1814 ; but the actual date of the publication of which I have reason to believe was somewhat later, and very nearly corresponding with that at which M. de Jussieu was in possession of a copy of my essay containing the observations already quoted. I conclude it is not supposed I could have been acquainted with the passage in the original memoir, unless the report usually made on memoirs read to the Institute should have been printed, and should have actually noticed this passage or the discovery it is now said to contain.

But independently of the near equality of dates, I cannot consider

sider my observations as either wholly or even in any considerable degree anticipated by the passage in question. My observations notice not only the disposition of the five vessels in the tube of the corolla, but their ramification in the laciniaë, by no means a necessary consequence of that disposition; they notice also the existence, in several genera of Compositæ, of five vessels alternating with those, and which I considered secondary in this order, though they occupy the place of the primary vessels in other families: and it is this inverted disposition, indicated in the greater part of the class by the primary being the only vessels existing, which I have considered as of material importance in determining the limits of Compositæ, though by no means as affording an essential practical character for the whole class.

In the passage quoted from M. Cassini (the only one I can find relative to the subject in the memoir in which it occurs), the existence of five nerves or vessels in the tube of the corolla, alternating with its laciniaë, is stated, but their division and disposition in the laciniaë are not noticed; it is at the same time to be inferred from the terms of the passage, that no other vessels exist in the tube of the corolla: and it is equally evident that, so far from announcing this disposition of vessels as a discovery, or peculiar to the order, the author rather considers it either as a fact already known, or as the usual structure. That M. Cassini was not then aware of the importance of the fact which he had imperfectly stated, appears likewise from his having, many months after his memoir was read, and at a time when he says he had finished his analysis of the corolla, proposed a name for the class, taken from a supposed peculiarity in the structure of the filament, a name which he is now inclined to abandon for one derived from the disposition of vessels in the corolla.

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Since my attention has been again turned to the subject, I have endeavoured to collect all that has been observed on the nerves or vessels of the corolla of *Compositæ*, a brief account of which may be not altogether without interest.

The earliest notice I have been able to find is contained in a passage (in page 170) of Grew's *Anatomy of Plants*, where, in speaking of syngenesious flosculi, he says, "they are frequently ridged, or as it were hem'd like the edge of a band." And his figure of a magnified floret of the common Marigold, in tab. 61, gives a tolerable idea of the marginal vessels of its lacinia. Grew however takes no notice of the trunks from which these branches arise, either in his text or plates.

Van Berkhey, in his *Dissertation on Compositæ*, published at Leyden in 1760, though he makes no mention of the nerves of the corolla in his text, yet in all the magnified figures he has given both of ligulate and tubular florets, correctly represents the trunks of the primary vessels, without however noticing their ramification in the lacinia. I am anticipated therefore by this author's figures exactly in the same degree as by the passage contained in M. Cassini's second memoir.

The accurate Schmidel, in the few *Compositæ* which occur in his *Icones*, has correctly represented the trunks of the primary vessels, but has equally omitted their ramifications.

In the *Analysis Florum* of Batsch, a work published in 1790, the object of which was to give an idea of the structure of the natural families of plants, by a minute description and magnified figures of one or more species selected from each, *Coreopsis tripteris* occurs; and although the vessels of its tubular floret are very indistinctly figured, yet both their trunks and branches are correctly described. The same author however, who in 1802 published

lished an ingenious work on the natural families of plants*, takes no notice of the vessels of the corolla in the character of *Compositæ* which he has there proposed.

In the figures of syngenesious plants given by Schkuhr †, wherever the ligulæ of *Cichoraceæ* are magnified, the trunks of the nerves are correctly represented ending in the sinuses; unless in one plate containing *Lactuca virosa* and *Sonchus sibericus*, in both of which the vessels are made to pass through the axes of the teeth; but in no case are the marginal branches noticed. It is singular that this generally accurate author, in the many magnified figures he has given of tubular florets, has only in two cases represented the trunks of their vessels, namely in *Echinops Ritro*, where they are correctly placed, and in *Silphium trifoliatum*, where, though only five vessels are visible, they are erroneously made to pass through the axes of the lacinia.

The only remaining author that notices these vessels is M. Mirbel, who in the second part of his valuable *Elémens de Physiologie Végétale et de Botanique*, published in 1815, introduces into his character of *Compositæ* the fact of the lacinia of the corolla being furnished with marginal nerves. This observation, if not original, the author may have adopted either from my essay already quoted, of which he was in possession soon after its publication, or from M. Cassini's third memoir, which was read to the Institute of France six months after that essay appeared: but he could not have derived it from the passage in that author's second memoir, on which he rests his claim; no notice being there taken of the disposition of vessels in the lacinia.

In M. Cassini's memoir expressly on the Corolla of *Compositæ*, which was read to the Institute of France in December 1814, and of which an abstract, by the author himself, is given in a late

* *Tabulæ affinitatum regni vegetabilis.*

† In *Botanisches Handbuch.*

number of the *Nouveau Bulletin des Sciences*, the disposition of vessels in the corolla is expressed in the following terms :

“ Chacun des cinq pétales dont se compose la corolle est muni de deux nervures très simples qui le bordent d'un bout à l'autre des deux côtés, et confluent par conséquent au sommet.”

On this statement I have several remarks to offer. And first, I object to its hypothetical language. Whatever opinion may be formed of the theory here adopted by the author, namely, that every monopetalous corolla is in reality composed of several confluent petals ; a theory first proposed by Linneus himself in his *Prolepsis Plantarum*, and ably supported on different grounds by Mons. Decandolle in his excellent *Théorie Élémentaire de la Botanique* ; I can see no advantage in adopting its language in stating a fact of this kind, especially if proposed as a practical character.

For my own part, I consider this opinion as correct in the sense in which it was held by Linneus, without, however, connecting with it the ingenious hypothesis of M. Decandolle, namely, that petals are only modified stamina. It remains to be seen on what ground M. Cassini has adopted this theory, as proposed by M. Decandolle, for *Compositæ*, the only family which seems to present a very important objection to it, in having its principal, and in the greater part of the order its only, vessels occupying the lines of junction of the supposed united petals.

To adapt this disposition of vessels to the theory, M. Cassini is obliged to subdivide their apparently simple trunks ; a division, however, which may be regarded as entirely hypothetical. From the observations I have made on the subject, I have no doubt that these trunks are equally simple with the secondary nerves when present, or with the primary in other families. I find them to consist of two kinds of vessels, the spiral and ligneous. Of the spiral vessels

vessels there are generally several in the cord : in *Helianthus multiflorus*, however, I have not been able to find more than one, either in the trunk of the nerve above the insertion of stamina, or in the branches of the laciniaë. It will be of some interest to verify this fact (which I by no means give with absolute confidence), both on account of the apparently formidable objection it presents to the theory in question, and also that, in following it up by an examination of the point of division, a clearer idea may be obtained of the ramification of spiral vessels than has hitherto been given.

My second objection to M. Cassini's account is, that he describes the nerves as marginal through their whole length. I have formerly, in the passage already quoted, stated them to be parallel and approximated to the margins of the laciniaë. Perhaps in no instance can the branches be considered as strictly marginal; in many cases they are manifestly distinct from the margins, and in the genus *Hymenopappus* are further removed from them than from the axis of the laciniaë. In *H. scabiosæus* there is also an evident inequality of the two branches in each lacinia, the stronger extending nearly to the apex, while the weaker either entirely disappears before it reaches the stronger, or unites with it considerably below its termination. In *H. tenuifolius* this irregularity is still greater; one branch being not unfrequently altogether wanting, and even the remaining branch considerably weakened: where this happens a secondary vessel is always produced, though very few flosculi are furnished with five complete middle nerves.

To the fact stated by M. Cassini that the lateral nerves are always simple, I have met with only one apparent exception, in an unpublished species of *Madia*, where they are connected by a few branches with the secondary or middle nerve, which in this

plant is more strongly marked than the primary, and from which indeed these connecting branches probably originate.

It must, I think, be admitted by M. Cassini, that in many genera of Compositæ five vessels passing through the axes of the segments exist, even ten others are occasionally found, as in *Helianthus*, though these can hardly be traced below the insertion of stamina. But as it has been already shown that the lateral or primary vessels are not strictly marginal through their whole length, and as one instance has been produced in which their branches, if not themselves subdivided, are at least connected by ramifications of the middle nerves*, it follows that a monopetalous corolla having in its tube fifteen nerves with distinct origins, three of which are continued through each of its segments, and unite together at the apex, would upon the whole better correspond with the definition M. Cassini has given of the corolla of Compositæ, than the actual disposition of vessels in that order. Now such a structure exists in the whole of *Goodenoviæ*†, a family of plants very nearly related
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* M. Cassini himself (in a note to his third memoir published in the *Journal de Physique* for February 1816, p. 129) has given another instance of the ramification of nerves in *Iva frutescens*.

† I have formerly observed (in *Prodr. Flor. Nov. Holl.* p. 580, and in *General Remarks on the Botany of Terra Australis*) that *Euthales* and *Velleia*, genera belonging to *Goodenoviæ*, exhibit the remarkable and nearly peculiar character of a corolla having the lower part of the tube cohering with the ovarium, while the calyx is entirely distinct. I have at the same time remarked that, even in those genera of the same natural family in which the calyx is coherent, the tube of the corolla may be supposed to be continued down to the base of the ovarium; and that this becomes even evident in such species as have the adhering part dilated into nectariferous processes; or in those where, the segments of the calyx not being closely approximated, the coloured corolla is visible in the interstices. In some species of *Goodenia*, particularly *G. decurrens* and *bellidifolia*, I find it practicable to separate not only the adhering calyx, but also the tube of the corolla from the ovarium. In the tube thus separated it appears that the lateral nerves, which preserve their parallelism to the middle nerve nearly to the base of the segment, become more evidently divergent below the
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to *Compositæ*. It exists also in *Ernodea*, in which the lateral nerves, though they give out externally a few branches, observe the same course, and terminate in the same manner in the laciniaë as those of *Compositæ*. A similar disposition is observable in certain genera of *Solanaceæ*, as *Datura* and *Cestrum*, though in these the lateral nerves are more ramified, and their trunks generally less distinct in the laciniaë. It appears therefore that, in adopting M. Cassini's theoretical expression for the vascular structure of

point of adhesion, and in such a degree that the corresponding branches of the neighbouring segments unite with each other considerably above the middle of the tube, forming a common trunk, which is continued to the base of the ovarium; the five trunks thus formed uniting internally with those from which the filaments originate, and externally with the axes of the opposite segments of the calyx. The middle nerves of the segments of the corolla are in like manner continued below the point of cohesion to the real base of the tube.

The analogy of this disposition of vessels in the corolla of *Goodenoviæ* to that of *Compositæ* is obvious. To assimilate entirely the two structures, it is only necessary to suppose a deeper division of the five primary vessels of *Compositæ*, and a continuation of the tube of the corolla below its apparent base to that of the ovarium. That this is its real origin, is rendered not improbable both from the analogous structure now described in the family of *Goodenoviæ*, and from the manifestly hypogynous corolla of *Brunonia*; a genus in many respects still more nearly related to *Compositæ*, though differing in the disposition of the vessels of its corolla.

The more direct proof of this origin, derived from an examination of the surface itself, can hardly, perhaps, be expected where the parts are generally so small, and where, as I conceive, the surface of the pericarpium in many cases depends less on that of the cohering envelopes, than on the proper figure of the ovarium itself, as seems to be likewise the case in *Umbellatæ*.

There are however a few cases in which this opinion respecting the origin of corolla in *Compositæ* may derive some additional support from the appearance of the surface of the ovarium, as in *Morshallia* and *Hymenopappus*, in both of which genera, but particularly in the former, it is marked with ten longitudinal striæ, of which the five stronger are continued into the five nerves of the corolla, the remaining five ending abruptly at the apex of the ovarium.

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the corolla of *Compositæ*, one peculiarity actually existing is lost*.

The principal peculiarity, however, consists in the corolla of a syngenesious plant, when reduced to its smallest number of nerves, having these nerves alternating with its segments in the tube. I am acquainted with no instance of this order of reduction in the nerves of any other monopetalous corolla, but I observe an apparent tendency to it in *Portlandia* and *Catesbæa*. In the tube of the corolla of both these genera there are ten nerves, of which the five that alternate with the segments are manifestly stronger, and seem to furnish the greater part of the vascular system of the upper part of the tube and of the segments; the intermediate nerves being there somewhat like recurrent branches.

I shall conclude this subject by observing, that although the existence of nerves alternating with the segments of a monopetalous corolla, dividing below the sinus and uniting their branches at the apex of the segment, be rare, this disposition is comparatively frequent in a monophyllous calyx, especially where its æstivation is valvular. *Labiata* furnish the most striking examples of this structure. I am not however acquainted with any instance of a calyx having five nerves only, and those alternating with its segments.

The æstivation or condition of the corolla before expansion is the subject of my *second* remark on *Compositæ*. I have, in the

* A still stronger objection to M. Cassini's definition is, that while its application to *Compositæ* is only hypothetical, it very nearly corresponds with the actual disposition of vessels in certain polypetalous genera. Thus in *Pittosporum revolutum*, each of the petals has three nerves with distinct origins. Of these the two lateral, evidently within the margins, less so, however, than in *Hymenopappus*, are quite simple in the unguis, and ramify more or less in the lamina, near the top of which they unite with each other and with the middle nerve.

observations formerly quoted, stated this to be *valvular*, that is, having the margins of the segments applied to each other and dehiscing like the valves of a capsule. As I have remarked in the same place that this æstivation exists in several other families, it is rather surprising that M. Cassini, in the abstract of his third memoir given in the *Nouveau Bulletin des Sciences* for last October, should seem to consider this character as peculiar to *Compositæ**. It appears also that he is not aware of any exception to it in the class. I have however, in a different part of the same essay, noticed one exception existing in *Chuquiraga*, and I have since found another in *Corymbium*. In both these genera the æstivation is induplicate, that is, the margins of the segments are doubled in, so that in the unexpanded state none of them are visible. I have

* Since this paper was read, M. Cassini has published his memoir (in the *Journal de Physique* for February 1816), in which he states the same æstivation to exist in certain other families, namely, *Campanulacæ*, *Lobeliacæ*, and *Rubiaceæ*. This observation, if applied to the whole of these families, as is evidently the author's intention, is correct only with respect to *Campanulacæ*, from which I have separated *Stylidæ* as a distinct order, partly, as I have stated, on account of its imbricate æstivation. In a considerable part of the *Lobeliacæ* of Jussieu, which includes my *Goodenoviæ*, the æstivation is not valvular but induplicate: and though in *Rubiaceæ* the valvular mode is very general, there are many remarkable exceptions to it, as *Gardenia*, *Ixora*, *Pavetta*, *Coffea*, and several other genera, where it is unilaterally and obliquely imbricate, as in most of the *Apocineæ*, with which Linneus united them under the name of *Contortæ*, derived from this very circumstance. On this subject I may be allowed further to remark, that M. Cassini, who in the memoir now cited has repeatedly asserted his claim to the priority of the observation on the disposition of vessels in the corolla, has in treating of its æstivation omitted to notice what had been already published respecting it in my essay above quoted, where I conclude he must have seen my observation, as he refers to the sentence containing it. The æstivation of corolla in *Compositæ* is also noticed in the observations on *Brunonia*, contained in my *Prodromus Floræ Novæ Hollandiæ*, which I suppose he has not seen: I may therefore, for the general importance of æstivation of calyx and corolla in affording characters both for Orders and Genera, refer him to almost every page of the same work, and to its preface, for an observation on the degree of attention that had been previously paid to this point of structure, which will enable him to correct in some measure his own remark on the subject.

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in the passage referred to observed that the valvular and induplicate modes of æstivation easily pass into each other, merely by an addition or abstraction of the elevated margins of the lacinix: instances of their abstraction, and of the consequent conversion of the induplicate into the valvular mode, occur in several Goodenoviæ, and in some Convolvulaceæ and Solanaceæ; while *Chuquiraga* and *Corymbium* are examples of their addition in an order where they are generally wanting.

My *third* remark is entirely borrowed from Schkuhr*, who states that in all *Cichoraceæ* or *Ligulataæ* the pollen is angular, and that in *Corymbiferæ* and *Carduaceæ*, or in all tubular florets, it is spherical or oval.

All the figures which this author has given of pollen in *Cichoraceæ* represent it as a regular icosahedron, except that of *Geropogon glabrum*, which is a dodecahedron. I believe neither of these forms of pollen has been observed in any other family of plants.

A *fourth* remark on *Compositæ* I do not offer with absolute confidence, as it is opposed to the statement of M. Cassini, on whose general accuracy I have great reliance. It relates to the disposition of the branches of the style or stigmata, which according to M. Cassini are lateral, or right and left with relation to the axis of the common receptacle; whereas, I consider them as anterior and posterior, though in many cases by a slight degree of twisting in the style they acquire what M. Cassini regards as their original position.

This may seem a point of very little consequence to establish. Independent however of the necessity of minute accuracy in every case, it appears to me to have some connexion with my *fifth* remark, which relates to the internal structure of the Ova-

* Botanisches Handbuch 3. p. 6.

rium of *Compositæ*. I am not aware of any thing having been yet said on this subject further than that it contains a single erect ovulum, inserted at the base of the cavity. In addition to this, I observe in the greater part of *Compositæ*, whose ovarium I have examined, two very slender filiform cords, which, originating from opposite points of the base of the ovulum, or of its short footstalk, run up, and are more or less connected with, the lateral parietes of the ovarium, until they unite at the top of its cavity, immediately under the style; between which and the ovulum a connexion is thus formed. In many cases, as in *Liatris spicata* and *Tussilago odorata*, these cords are easily separable from the ovarium, and have such a degree of tenacity that they may be extracted from it entire, along with the ovulum. In other cases they more firmly cohere with the sides of the cavity: and in those plants in which I have been unable to see them distinctly, I conclude they are not absolutely wanting, but that their connexion with the parietes is still more intimate.

These cords may be supposed to consist either solely of the vessels through which the ovulum is fœcundated, or to contain also the remains or indications of a system of nourishing vessels, or chordæ pistillares, the position of which points out the true nature of the ovarium in this class, or the relation it has to the apparently less simple ovarium of other families. I am inclined to adopt the latter supposition. In order, however, to be understood on this subject, it is necessary to premise that I consider the pistillum or female organ of all phænogamous plants to be formed on the same plan, of which a polyspermous legumen or folliculus whose seeds are disposed in a double series may be taken as the type. A circular series of these pistilla, disposed round an imaginary axis, and whose number corresponds with

that of the parts of the calyx or corolla, enters into my notion of a flower complete in all its parts.

But from this type and number of pistilla many deviations take place, arising either from the abstraction of part of the complete series of organs, from their confluence, or from both these causes united; with consequent abortions and obliterations of parts in almost every degree. According to this hypothesis, the ovarium of a syngenesious plant is composed of two confluent ovaria; a structure which is in some degree indicated externally by the division of the style, and internally by the two cords which I consider as occupying the place of two parietal placentaë, each of these being made up of two confluent chordulaë, belonging to different parts of the compound organ. I am well aware how very paradoxical such an hypothesis must seem, especially when applied to a structure apparently so simple as that of the ovarium of *Compositæ*; and I therefore regret that I am not yet fully prepared to bring forward in its support a series of facts already in my possession, consisting of deviations from the usual structure of organs, and particularly of instances of stamina changed into pistilla.

In the mean time it may give some plausibility to the hypothesis to remark, that there are families of plants strictly natural in which a series of degradations exist, if I may so speak, from the assumed perfect pistillum, to a structure as simple as that of *Compositæ*.

Thus in *Proteaceæ* we have the type of the perfect pistillum in the many-seeded folliculus of *Embothrium*; the first degree of imperfection in that of *Grevillea*, where only one ovulum of each series remains; a further reduction in the indehiscent monospermous fruit of *Leucospermum*, in which the insertion of the ovulum is lateral; and the simplest form in *Protea* itself, where
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the single ovulum is inserted at the base of the cavity. Proteaceæ, however, exhibit a series of obliterations in the parts of a single pistillum only. An illustration more in point, though somewhat less perfect as a series, may be taken from *Goodenoviæ*, an order of plants very nearly related to the class of which we are treating. In the greater part of *Goodenoviæ*, the ovarium is bilocular, each cell having an indefinite number of seeds; in the greater number of *Scævola*, each cell is reduced to a single ovulum; while in some species of the same genus, and in all the species of *Dampiera*, the ovarium, though retaining its external characters, is reduced to a single monospermous cell, with an erect ovulum, as in *Compositæ*. The natural order *Cruciferæ* exhibits also obliterations, more obviously analogous to those assumed as taking place in syngenesious plants; namely from a bilocular ovarium with two polyspermous parietal placentæ, which is the usual structure of the order, to that of *Isatis*, where a single ovulum is pendulous from the apex of the unilocular ovarium. And lastly in the genus *Bocconia*, in the original species of which (*B. frutescens*) the insertion of the single erect ovulum has the same relation to its parietal placentæ, as that of *Compositæ* has to its filiform cords, a second species (*B. cordata*) exists in which these placentæ are polyspermous.

My *sixth* observation on *Compositæ* regards the order in which the florets expand. To understand the relation this order has to that of other families, it may be necessary first to make a few remarks on the more usual modes of inflorescence.

It is well known that in an absolutely simple spike the expansion of the flowers is ascendent; that is, begins at the base of the spike and proceeds regularly upwards. To this order very few real exceptions occur, several of the apparent deviations being connected with some degree of composition in the spike.

It is also known that in a compound spike; while the expansion of each partial spike is ascendent, that of the spikes, with relation to each other, is descendent; the terminal spike expanding first, and the others in a regular succession downwards. This order, indeed, admits of a greater number of exceptions than that of the simple spike; several of them apparently depending on the density or imperfect composition of the spike; and the more usual deviation consisting in the expansion beginning below the apex, and proceeding in opposite directions from the point of commencement; the upper portion following the order of the simple, the lower that of the compound spike*.

The simple racemus and corymbus are obviously very slight modifications of the spike, and in their expansion obey the same law.

A syngenesious compound flower, or *capitulum* as it may be termed, is merely a spike with a shortened and generally depressed axis. In cases where this capitulum is unquestionably simple, the expansion of its flowers is uniformly from circumference to centre, or in the order of the simple spike. Where the capitula are disposed in a corymbus, which is their usual mode of combination, the order of the compound spike is observed; their expansion with relation to each other being from centre to circumference. In their denser aggregations, whether forming a compound spike or head, the same order of expansion obtains, and it continues through the florets in each common calyx or involucre should be lessened in number, or even reduced to unity, as in *Echinops* and *Rolandra*.

* The most remarkable exception to the order of the compound spike exists in the compound umbel of Umbelliferæ, of which the outer umbellulæ expand somewhat earlier than the central; and as this order of expansion seems to extend through the whole natural family, *Astrantia*, in which the terminating umbel expands much earlier than those of the lateral branches, cannot be considered as having a compound umbel.

The absolute constancy in the order of expansion of the simple capitulum from circumference to centre, and the more or less complete inversion of this order in the compound capitulum, appear to afford tests of the real structure in certain cases where the degree of composition, and consequently the proper names of some of the parts, might otherwise be doubtful.

To illustrate this I select two genera, *Lagasca* and *Casulia*.

In *Lagasca* the capitulum, both from its form and the appearance of its involucre, might at first sight be considered as simple: on examination, however, it is found to differ from all simple capitula, in each floret being furnished with a tubular envelope, exactly resembling a five-toothed perianthium, but which does not in any state cohere with the included ovary.

Cavanilles, by whom the genus was established, regarded this envelope as a genuine perianthium, and erroneously described its tube as cohering with the ovary; an error which is copied in Persoon's *Synopsis Plantarum*, where the genus is consequently placed in *Polygamia æqualis*. Jacquin, who has published *Lagasca* under the name of *Noccea mollis**, also describes the envelope of each flower as a proper perianthium, although aware of its tube being distinct from the ovary. Subsequent writers have, indeed, more correctly referred the genus to *Polygamia segregata*; but the terms involucre and calyculus, which they apply to the envelope in question, appear to me objectionable, for a reason that will presently be given.

Three suppositions may be formed respecting the nature of this envelope, namely, either that it is an involucre reduced, as in *Echinops*, to a single flower; secondly, that it is a proper perianthium, which in appearance it very much resembles; or thirdly,

* *Fragm. Bot.* p. 58. tab. 85.

that

that it is more analogous to the outer calyx of *Scabiosa*, which M. Cassini seems to consider different in its nature from both these parts.

But the order of expansion in *Lagasca*, which is, though with some degree of irregularity, from centre to circumference, or that of the compound capitulum, seems to decide the question respecting the envelope of each flower, and to establish its identity with involucrem: nor does this involucrem differ materially from that of *Echinops*, except in the reduced number and confluence of its component parts.

The real structure of *Cæsulia* is perhaps less obvious.

This genus, which was first published by Dr. Roxburgh*, is referred by him to *Polygamia segregata*; the tubular envelope or involucrem of each floret being described as distinct from the included ovarium.

Kœnig, on the other hand, by whom the genus was discovered, and whose account of it is given in the same work, describes the partial involucrem of Roxburgh as the surface of the ovarium itself; its segments being, according to him, a pappus of two leaves. And lastly Willdenow, regarding this involucrem as merely paleæ of the receptacle, refers the genus to *Polygamia æqualis*; in which order it is continued, both in Persoon's *Synopsis*, and in the second edition of Mr. Aiton's *Hortus Kewensis*.

This last view of the structure seems the most erroneous of any, and was probably adopted by Willdenow, in consequence of his having added to the genus a second species not really belonging to it, and which I shall have occasion to notice in another part of my subject.

An examination of the parts of fructification in different stages

* In *Corom. Plants*, i. p. 64. t. 93.

reconciles the opposite statements of Kœnig and Roxburgh; for I find that at the time of flowering the envelope of each floret is, as Roxburgh has figured it, distinct from the ovarium, with which, however, in a more advanced stage its tube becomes firmly united; a fact that sufficiently accounts for Kœnig's description.

There is here, therefore, a nearer approach to a true perianthium than in the involucrem of *Lagasca*; but the expansion of the flowers being, as in that genus, from centre to circumference of the capitulum, I consider the envelope of *Cæsulia* as unquestionably an involucrem, and the genus consequently belonging to *Polygamia segregata*.

I may here remark, that the name *Polygamia segregata*, invented by Linneus for those genera of *Compositæ* with densely aggregate capitula, is calculated to give an erroneous idea of the nature of the structure; the opposite term *Polygamia congregata* being, according to the view now taken, obviously more proper for those genera, at least, whose involucra contain several flowers. It is not unlikely, indeed, that Linneus himself was aware of the true nature of the inflorescence of these genera; but the term *Polygamia congregata* would not have suited the artificial arrangement which he adopted in his subdivisions of the class, nor his including in it the order *Monogamia*; for with this order the single flowered genera of *Polygamia segregata* must then have been confounded.

It is a curious circumstance, that the order of expansion in *Compositæ* does not depend on the number of flowers actually existing, but on the effort, if I may so term it, made to produce them, manifested by the presence of an involucrem or common calyx, which is in some cases reduced to a single flower. The fact at the same time contributes to prove, that the whole natural class is formed on that plan of dense aggregation of flowers,
for

for which I have already attempted to show that certain parts of the structure of a syngenesious floret are peculiarly well adapted.

The circumstance, however, is not confined to *Compositæ*, but exists in an equally remarkable degree in *Gramineæ*.

I have formerly considered the gluma, or what Linneus has termed calyx, in this family of plants, as an involucreum.

In those genera where this gluma or involucreum contains several flowers their expansion is generally ascendent, or in the order of the simple spike. In a spike formed by these many-flowered glumæ, as that of *Triticum* and *Lolium*, the expansion of the partial spikes, with relation to each other, is descendent, or in the order of the compound spike; in most cases, however, with that deviation, which I have already noticed, of the expansion commencing below the apex and proceeding in opposite directions. But as the same descendent expansion takes place in a spike formed of single-flowered glumæ, it may be inferred that the genuine type or most perfect form of a grass is to have several flowers in its gluma or involucreum: a view not only consistent with the fact of a great majority of the order having actually this disposition; but also with that peculiarity in the vascular structure of the inner valve of the perianthium; which, whether it be considered as indicating that this part is formed of two confluent valves, an opinion I have elsewhere* advanced, or merely as a transposition of vessels in a simple valve, analogous to that in the syngenesious floret, is evidently adapted to the many-flowered spicula, though equally existing in that with a single flower.

The resemblance between the outer calyx of *Dipsacææ* and the single-flowered involucreum of *Compositæ* is so striking, that it

* In General Remarks on the Botany of New Holland.

cannot appear very paradoxical to consider them as both of the same nature.

In Dipsacæ, however, there is no instance of the outer calyx containing more than one flower, and the evidence afforded by inflorescence on this subject is not altogether satisfactory.

In *Dipsacus* it has been long noticed that expansion begins about the middle of the spike, and proceeds in opposite directions from the point of commencement: this order is evidently more analogous to that of the compound than of the simple spike; there being several instances of spikes manifestly compound, where the same inversion of the upper part exists.

But a fact, which I do not find any where observed, respecting the inflorescence of certain species of *Scabiosa*, particularly *succisa* and *atropurpurea*, is not so easily reconcilable with the compound spike: in these, and I have reason to think in many other species of the genus, the expansion begins simultaneously at the base and middle of the capitulum, proceeding regularly upwards from both points. Were this the case in all Scabiosæ, the compound nature of the spike in Dipsacæ, although by no means proved, might be considered not improbable: there are, however, several species of the genus in which the order of expansion is altogether that of the simple spike.

Connected with the subject of inflorescence, I may remark that priority of development, whether among similar parts in the same flower or the different flowers of the same spike, is generally accompanied with greater perfection of these parts or flowers, and apparently with greater power of resisting the ordinary causes of abortion or obliteration.

I have formerly * observed respecting several natural families of plants, in which the stamina are in a determinate number, but a

* In Prodr. Flor. Nov. Holl. vol. i. and Appendix to Flinders's Voyage to Terra Australis.

number subject to reduction, that this reduction, where the flower is of a regular form, takes place in the same order in each natural family. Thus in *Junceæ*, which are generally hexandrous, the triandrous species have their stamina constantly placed opposite to the three outer leaves of the perianthium, while in *Restiaceæ*, *Asphodeleæ*, and I believe in a great part of the regular-flowered *Liliaceæ*, in certain species of which a similar reduction occurs, the stamina in the triandrous species are placed opposite to the inner leaves or segments of the perianthium. But in both cases the greater perfection of those stamina that exist in genera or species reduced to the smallest number, is indicated, where there is no reduction, by the earlier bursting of their antheræ; so that from this circumstance the order of reduction or abortion of stamina in any natural family may with some confidence be predicted by an examination of those genera where the number is complete.

Wherever the separation of sexes takes place, it may be assumed that the female flower is the more perfect production. And if this be admitted, where both sexes exist in the same simple spike the female should be found at its base, or where expansion commences, which is almost uniformly the case. For the same reason, in the trifold or trichotomous inflorescence, the female should be placed in the centre, which is also generally the fact*.

This connexion between præcocity and perfection of development is even more constant than the order of expansion in certain forms of inflorescence; as it is found to extend to several of the exceptions to this order.

Thus in the apparently simple spike of *Poterium*, where the order of expansion is descendent, the female flowers occupy the

* To this order the most remarkable exception occurs in *Begonia*, in which the male flowers are central, and expand long before the lateral female flowers.

upper part of the spike ; and this relation also exists in the more compound inflorescence of *Ricinus*, *Syphonia*, and *Celtis*, in which the order of expansion is equally inverted.

It may seem rather paradoxical to select *Euphorbia* as an example of the same relation ; this genus being considered by Linneus, and the greater part of the botanists who have adopted his system, as having a dodecandrous hermaphrodite flower. We have already, however, I believe, sufficient evidence that this supposed hermaphrodite flower is in reality formed of several monandrous male flowers surrounding a single female*.

In conformity with this view of its composition, and with the relation above attempted to be established, the development of the pistillum precedes that of the stamina in many species of the genus.

It is more difficult to determine whether this order of expansion and relative position of sexes in *Euphorbia* be in conformity with the general rule, or an exception to it. For its fasciculus of flowers may be considered as analogous either to the simple spike, and consequently having an inverted order of expansion, as in *Allium descendens*, and certain species of *Grevillea* and *Anadenia* : or it may be assimilated to the compound spike, as in several species of the genus the male flowers appear to be separated into fasciculi ;

* To the arguments I have adduced (in my Remarks on the Botany of New Holland) in support of this opinion, I am now enabled to add the more direct proof derived from certain species of *Euphorbia* itself, in which the female flower is furnished with a manifest calyx. I have formerly observed, that in a few cases the footstalk of the ovarium is dilated and obscurely lobed at top : but in the species now referred to it terminates in three distinct and equal lobes of considerable length, and which being regularly opposite to the cells of the capsule may be compared to the three outer foliola of the perianthium of *Phyllanthus*, between which and the cells of the capsule the same relation exists. This calyx is most remarkable in an undescribed species of *Euphorbia* from the coast of Patagonia, in the Herbarium of Sir Joseph Banks ; but it is observable, though less distinct, in *E. punicea* and several other species.

and according to this view the order of expansion is direct, the central female flower being the representative of the terminal partial spike.

There is even a third species of inflorescence with which the fasciculus of *Euphorbia* may be compared, namely, that consisting of one or more verticilli with a single flower in the centre. In this, which may be considered a modification of the spike or umbel, the usual order of expansion seems to be from centre to circumference. Its simplest form occurs in an unpublished New Holland genus of the same natural family with *Euphorbia*, in which a single verticillus of male flowers surrounds the central female flower. *Lambertia* may be considered as another instance of the same mode, and as far as can be determined, in a case where the flowers are hermaphrodite and their expansion nearly synchronous, following the same order. In all the known species of this genus the leaves are verticillate, and uniformly in threes: in *L. formosa* and *inermis* the involucre constantly contains seven flowers, while in *L. uniflora* it is reduced to one flower. The seven flowers of the two former species I consider as made up of two verticilli, in number of flowers corresponding with that of the leaves, and of a single central or terminal flower; to which terminal flower *L. uniflora* appears to be reduced. From this order of reduction it may be assumed as more probable that species of *Lambertia* should be found with ten or four flowers in the involucre than with nine, six, or three. But greater permanence being, as has been already remarked, generally connected with greater perfection, it becomes also probable that, if any species of this genus should be discovered with androgynous capitula, the female flower will occupy the centre as in the genus of Euphorbiacæ above referred to.

It is worthy of remark, and may indeed appear in some degree
at

at variance with the foregoing observations, that although in an assemblage of flowers priority of expansion generally indicates a greater degree of perfection, and consequently a more ready convertibility of the hermaphrodite into the female flower; yet in a hermaphrodite flower the development of stamina usually precedes that of pistilla. The most remarkable exceptions to this order of development which I at present remember, occur in several species of *Plantago*, where the stigmata are fully developed, and often even withered, before the bursting of the antheræ.

I now proceed to make some remarks on certain genera of *Compositæ* which either occur under different names in late systematic works, or whose structure and limits seem to be imperfectly understood.

SOLIVA

was established in the *Prodromus Floræ Peruvianæ et Chilensis*, and is adopted by Persoon in his *Synopsis Plantarum*.

To this genus *Hippia minuta* of the Linnean Herbarium unquestionably belongs, and it is perhaps not specifically distinct from *Soliva pedicellata*. But on comparing the structure of this plant with the figures and descriptions, given by Mons. de Jussieu (in the fourth volume of the *Annales du Museum*), of the different species of his *Gymnostyles*, it appears to me evident that the whole of this genus is referable to *Soliva*, whose principal characters would consist in the want of corolla or perhaps its accretion with the persistent style in the female florets; in the pericarpia being more or less winged, and presenting their disk instead of their margins to the centre of the capitulum.

Sir

Sir James Smith has already pointed out the error M. de Jussieu has been led into in referring *Hippia minuta* Linn. to his *Gymnostyles nasturtiifolia*, a plant much more nearly related to *Hippia stolonifera* of Brotero ; which, from repeated examination, I can with confidence refer to the same genus.

Gymnostyles anthemifolia is stated by M. de Jussieu to be a native of New South Wales : but as I have observed it only in cultivated ground in the neighbourhood of Sydney, and as it has certainly been found in South America, of which four other species of the genus are unquestionably natives, it has probably been imported into New South Wales, perhaps from Brazil ; nor is it altogether improbable that *Hippia stolonifera* of Brotero may have been introduced into Portugal from the same quarter.

GRINDELIA,

described by Willdenow in the Transactions of the Natural History Society of Berlin for 1807, and subsequently in his Enumeratio Plantarum Horti Berolinensis, flowered in Kew Gardens for the first time in 1815, when I had an opportunity of examining it, and of determining its very near affinity with *Donia*, a genus proposed in the second edition of Hortus Kewensis, and adopted by Mr. Pursh in his Flora of North America: the principal distinction between these two genera consisting in a difference in the number of radii of the pappus, which in *Grindelia* is described by Willdenow as of two rays, and according to my observations has more frequently one only. But as even in *Donia* the number of rays, though indefinite, is variable, and the structure of the pappus is very nearly similar in both genera, which in all other respects agree, it may be perhaps expedient to unite them under the name of *Grindelia*, which was first in order of publication.

TRIDAX

TRIDAX

was first established by Linneus, in *Hortus Cliffortianus*, from a specimen found at Vera Cruz by Houston, and sent to Clifford by Miller. As Linneus had no specimen in his own collection, that in Clifford's Herbarium, now in the possession of Sir Joseph Banks, is the only authority for the genus; and on examining this specimen I find the pappus to be not setaceous, as Linneus has described it, but distinctly plumose. There is, therefore, no difference whatever between *Tridax* and *Balbisia* of Willdenow; and on comparing *Tridax procumbens* with *Balbisia elongata*, I cannot satisfy myself that they are even specifically distinct.

ANGIANTHUS.

Angianthus tomentosus of Wendland's *Collectio Plantarum*, (vol. ii. p. 32. tab. 48.) published in 1809, is evidently the same plant as my *Cassinia aurea*, described in the fifth volume of the second edition of *Hortus Kewensis*, which did not appear till 1813. Wendland neither mentions the native country of his *Angianthus*, nor from whence he received it. He must, no doubt, however, have obtained it from Kew Garden, where it was introduced and flowered from seeds which I collected in 1802, in the island of St. Francis, on the South coast of New Holland.

MEYERA.

This genus, described by Schreber in his edition of the *Genera Plantarum*, is not adopted by Willdenow. Swartz, however, in his *Flora Indiæ Occidentalis*, has referred to it, and I have no doubt correctly, *Eclipta sessilis* of his *Prodromus*. On comparing this species of *Meyera* with a plant in Sir Joseph Banks's Herbarium; collected in Peru by Dombey, and which exactly agrees with
Sobryea

Sobrya of the Flora Peruviana, it appears evident that this genus is reducible to *Meyera*. *Enhydra* of Loureiro's Flora cochinchinensis, though described somewhat differently, and referred to *Polygamia segregata*, I have little doubt, belongs to the same genus; as does unquestionably *Hingstha* of Roxburgh's unpublished Flora Indica, where it is also referred to *Polygamia segregata*. This plant, which I have examined, is scarcely distinct from a species of *Meyera* that grows in New South Wales.

Cryphiospermum of Mons. de Beauvois's interesting Flore d'Oware et Benin, although reduced by him to Cichoraceæ, I have but little hesitation in referring also to *Meyera*. And lastly, *Casulia radicans* of Willdenow, likewise a native of æquinoctial Africa, is perhaps not specifically different from *Cryphiospermum repens* of Mons. de Beauvois.

MELAMPIDIUM

was established by Linneus, in the first edition of *Genera Plantarum* and in *Hortus Cliffortianus*, from a specimen found by Houston near Vera Cruz, and communicated by Miller to Clifford, in whose Herbarium, now forming part of the collection of Sir Joseph Banks, it still exists. It does not appear that this plant has been found by any other botanist than Houston; and according to the character given by Linneus of *Melampodium*, it must be considered the only species of the genus.

In the second edition of *Species Plantarum* he added to it, but with a doubt, *Melampodium australe*, a plant adopted from Læfing, according to whose description the pappus and surface of the seed are widely different from those of the original species. Swartz has referred to the genus a third species, *M. humile*, entirely distinct in these respects from both the former; and more recently a fourth species, *M. longifolium*, with seeds differently modified from all the others, has been annexed to it.

But

But if these four plants, so extremely different from each other in pappus and form of the pericarpium, really belong to the same genus, as their habit seems strongly to indicate, there can be no reason to separate from them *Alcina* of Cavanilles, erroneously considered by Willdenow as a species of *Wedelia*: and *Dysodium* of Richard, published in Persoon's Synopsis, though differing from all the others in the form of its pericarpium and in that of its receptacle, must also be reduced to this genus. If, however, the part described by Linneus as pappus in *Melampodium americanum* be really such, and if the pericarpium itself vary so widely both in form and surface, it would be inconsistent with the principles of division generally adopted in Compositæ, to unite all these plants into one genus, notwithstanding their great resemblance in habit as well as in the other parts of fructification; and it would be at least in vain to look for any combining character in this part of their structure.

A careful examination of the female flowers, especially in an early stage, removes this difficulty, by proving that the supposed external coat of the ovarium, with its various inequalities of surface, some of which have been described as pappus, is in reality an involute bractea or foliolum of the involucre, like that of *Micropus*, completely inclosing the ovarium, but from which in several species of the genus it is entirely, and in others in great part, distinct.

CRASPEDIA

first appears in Forster's *Prodromus Florulæ Insularum Australium*, where an essential generic character is given, but no description of the species. The genus is adopted and the character received without remark by Willdenow in his edition of *Species Plantarum*, and by Persoon in his Synopsis. Among George Forster's drawings of subjects of natural history made in

Cook's second voyage, and now in the library of Sir Joseph Banks, there is a figure of this plant, from which it appears that he originally referred it to *Stæhelia*; a proof that he had not at that time very carefully examined it. It is not improbable therefore that he afterwards proposed it as a distinct genus, belonging to *Polygamia segregata*, from finding that this had been already done by Solander, whose name (*Cartodium*), however, he did not think it necessary to adopt, and with whose generic character he probably was not acquainted. In his own he very erroneously states that there is no partial involucre, and hence perhaps M. Labillardiere entirely overlooked *Craspedia* when he established his *Richea* from a nearly related species of the same genus. That such is the case I have long since briefly noticed*, and have ascertained by a comparison of the specimen of *Craspedia uniflora* in George Forster's Herbarium with *Richea glauca* of Labillardiere, and other species of the same genus which I have observed in New Holland.

M. Labillardiere's character of *Richea* is essentially correct. It is well to remark, however, that his general involucre is formed of the bracteæ subtending and in equal number with the outer partial capitula; and that the general receptacle has no other paleæ than the analogous bracteæ of the inner capitula. It is the more necessary to take this view of the structure, as I have found in New Holland a nearly related genus (*Calocephalus*), which differs from *Craspedia* and *Richea* in the want of these bracteæ, as well as in the partial receptacles being without paleæ, and in the rays of the pappus being plumose only in the upper part. I have also another genus of this tribe (*Lencophyta*) from the same country, differing from *Calocephalus* in having a general involucre consisting of a few short bracteæ, in the squamæ of its partial involucre being concave and bearded at top, and in the rays

* In Prodr. Flor. Nov. Holl. p. 555.

of its pappus being plumose through their whole length, as in *Craspedia*, from which it is distinguished by the want of paleæ on the partial receptacles, and very remarkably in habit.

I have selected the foregoing genera as having been either published under different names, or, as it appears to me, unnecessarily subdivided. In this extensive class it would not be difficult to point out a much greater number consisting of species improperly united. One very remarkable case of this kind is the genus

CALEA,

to which, as I intend to enter fully into the history and affinities of its species, I shall confine myself.

This genus was established by Linneus in the sixth edition of his *Genera Plantarum*, where the natural character is given: but the following essential character, which is still retained, appears for the first time in the twelfth edition of *Systema Naturæ*, in the third section of *Polygamia æqualis*:

“*Receptaculum* paleaceum, *Pappus* pilosus, *Calyx* imbricatus.”

The species originally referred to *Calea*, in the second edition of *Species Plantarum*, are *C. jamaicensis*, *oppositifolia*, and *Amellus*, described from specimens in Browne's *Jamaica Herbarium*, which he had received a few years before, and incorporated with his own.

These three plants Linneus had originally referred to *Santolina**, for which it seems to me rather less difficult to account than for his afterwards uniting them together to form his genus *Calea*; two of them, according to his descriptions†, though in reality one only, being without pappus, and in other respects corresponding with the generic character of *Santolina*; and the third, which

* In *Amœnit. Acad.* vol. v. p. 404.

† *Loc. cit.*

Browne had doubtfully referred to the same genus, though furnished with pappus, agreeing with the others in having opposite leaves.

But the difference in habit between all these plants and the original species of *Santolina* is so great, that it probably afterwards determined Linneus to remove them from that genus; and although he found a sufficient generic character in the pappus of *Calea jamaicensis* only, he united with it the two other species, for a reason perhaps similar to what I have supposed led him to separate all the three from *Santolina*. It is remarkable, however, that not one of these three original species of *Calea* corresponds with his character of the genus; and that they in reality belong to three very distinct genera, on principles which, I conceive, Linneus himself would have admitted.

The *first* species, *Calea jamaicensis*, is the only one that even seems to agree with the generic character, in having pappus which at first sight (to the naked eye at least) might appear simply capillary, but which on a closer examination proves to be of a very different and nearly peculiar structure. Of this species I have seen only one authentic specimen, received from Browne by Ehret, and now in Sir Joseph Banks's Herbarium. The specimen in question, though incomplete, evidently belongs to the same species with "*Conyza fruticosa* eisti odore, floribus pallide purpureis, summitatibus ramulorum insidentibus," of Sloane*, of which I have examined the original very perfect specimens in his Herbarium, preserved in the British Museum.†, and am satisfied that its pappus is of the same structure as that of *Calea cordifolia* of Swartz, who has well described it, but who has at the same time given a different account of that of *C. jamaicensis*‡. These

* Hist. Jam. i. p. 257. tab. 151. fig. 3.

† Herb. vol. v. fol. 14 & 15.

‡ In Flor. Ind. Occid. vol. iii. p. 1328.

two plants are the only published species of this genus, for which the name of *Calca* should be retained, and which may be distinguished by the following characters :

CALEA.

Caleæ species *Linnei*.

*Involucrum** imbricatum. *Receptaculum* paleaceum. *Flosculi* tubulosi, uniformes, hermaphroditi. *Antheræ* basi muticæ. *Stigmata* acuta. *Pappus* paleaceus: radiis uninerviis, pinnatifido-striatis.

Frutices (Americæ æquinoctialis,) *pubescentes, scabri*. *Folia opposita, indivisa*. *Capitula*† *corymbosa, v. terminalia, v. axillaria*. *Involucri subovati foliola nervosa, obtusa*. *Paleæ receptaculi convexi distinctæ, figura et textura fere involucris*. *Corollæ luteo-purpureæ* (Swartz), *glabræ, laciniis dinerviis*. *Achenium subcylindraceum v. obsolete angulatum, glabrum v. pubescens, callo baseos subobliquo*. *Pappus persistens albus, nitens; radiis simplici serie subulatis, indivisis, superne denticulatis*.

Obs. In Sir Joseph Banks's Herbarium there are two plants very nearly related to *Calea*, differing from it merely in having a radius of ligular female florets. If this difference be considered sufficient to constitute a genus, it may be named *Caleacte*. The first of these plants (*C. urticifolia*), with nearly ovate acute crenated leaves, found by Houston near Vera Cruz, is *Solidago urticifolia* of Miller, by whom it appears to have been cultivated. The second, with deeply lobed or pinnatifid leaves (*C. pinnatifida*), was lately sent from Brazil by Mr. Sellow.

The second Linnæan species, *Calea oppositifolia*, has very little affinity to the first. In attending merely to the technical character of *Suntolina*, it might be referred to that genus; but it dif-

* Calyx communis *Linnei*.

† Corolla communis *Linn*.

fers so widely, both in other points of structure and in habit, that there can be no question of the propriety of separating it, which may be done by the following character, and under the name of

ISOCARPHA.

Receptaculum conicum : *paleis* distinctis, conformibus : *extimis involucrem* constituentibus. *Flosculi* tubulosi, uniformes, hermaphroditi. *Antheræ* basi muticæ. *Stigmata* appendice elongato, hispidulo, acuto. *Achenium* prismaticum : *pappo* nullo.

Herbæ (Americæ æquinoctialis). *Folia opposita (vel alterna) indivisa*. *Capitula ovata, terminalia, terna (vel solitaria)*. *Paleæ lanceolatae*. *Corollæ albidæ*. *Antheræ basi truncatæ*.

Obs. I have so constructed the generic character of *Isocarpha* as to include *Spilanthus atriplicifolius* of Linneus, which, however, differs very remarkably from *Calea oppositifolia* in having alternate leaves and solitary capitula, as well as in the texture and form of its paleæ.

The pappus, consisting of three or four very minute aristæ, described by Swartz* in *Calea oppositifolia*, I have not been able to observe in any of the specimens that I have examined.

The *third* species, *Calea Amellus*, is probably the same plant as *Bidens scandens*, which Linneus described in *Hortus Cliffortianus*, but, having no specimen in his own collection, appears to have forgotten. The original specimen in Clifford's Herbarium, now in the possession of Sir Joseph Banks, evidently belongs to the same species, and perhaps to the same individual, with a specimen in Miller's collection, which Mr. Dryander compared, and considered to agree with *Calea Amellus* of the Linnean Herbarium. The true synonym, therefore, of *Calea Amellus* is "*Bidens suffruti-*

* In *Obs. Bot.* p. 302.

eosus vimineus, foliis oblongo-ovatis oppositis; floribus comosis" of Browne* ; while Linneus has quoted and even derived his specific name from the same author's "*Amellus ramosus, foliis remotis terminalibus, fulcris longis divaricatis †;*" which, instead of belonging to *Bidens scandens*, I believe, for the following reasons, to be *Bidens nivea*. 1st, The figure in Burmann's *Thesaurus Zeylanicus* ‡, quoted by Browne for his plant, though belonging to *Lavenia erecta*, is at the same time a good representation of *Bidens nivea*, and very unlike *Bidens scandens*. 2dly, Browne's description in most respects very well agrees with the former species, but certainly not with *Bidens scandens*. And 3dly, I infer that *Bidens nivea* was actually in Browne's Herbarium, from finding it in the *Flora Jamaicensis* published in the 5th volume of *Amœnitates Academicæ*, and formed chiefly from that Herbarium ; though a very erroneous reference for this species is there made to Browne's first *Santolina*, which, from the description, cannot possibly belong to *Bidens nivea*, but is probably *Verbesina gigantea*.

M. Decandolle has lately established a new genus, *Salmea*, consisting of *Bidens scandens*, *Bidens hirsuta*, and a third species which I have not examined. These plants are very properly separated from *Bidens* by this excellent botanist, and well distinguished both from that genus and from *Melananthera*. It is rather remarkable, however, that he has not thought it necessary to compare *Salmea* with *Spilanthus*, from which, according to his description, it differs only in its imbricate involucre. But as in *Spilanthus* the foliola of the involucre are not exactly equal, and are disposed at least in a double series, I have in-

* Browne, *Jam.* 317.

† *l. c.*

‡ *Eupatoriophalacrum serophulariæ aquaticæ foliis oppositis, Burm. Thesaur. Zeyl.* p. 95. t. 42.

troduced

troduced some additional distinctions into the following character of

SALMEA.

Decandolle in Cat. Hort. Monspel. p. 140.

Involucrum imbricatum. *Receptaculum* conicum, paleis persistentibus. *Flosculi* tubulosi, uniformes, hermaphroditi (5-fidi). *Anthæ* sagittatæ. *Achenium* verticaliter compressum, bi-aristatum; *aristis* persistentibus (apteris v. alatis).

Frutices (Americæ æquinoctialis) sæpius decumbentes. Folia opposita, indivisa. Inflorescentia terminalis, subpaniculata, vel corymbosa. Corollæ albida. Paleæ receptaculi post lapsum pericarpiorum persistentes.

OBS. Of this genus I have examined specimens of three species in Sir Joseph Banks's Herbarium, differing from each other in several very remarkable characters.

1. *Salmea scandens*, (Decand. l. c.) in which the aristæ are equal and without any membranaceous border: stigmata remarkably dilated, tongue-shaped, obtuse; not hispid, obscurely papulose, and apparently without any terminal appendix: style dilated at the base into a hemispherical bulb which is truncated underneath.

2. *Salmea hirsuta*, (Decand. l. c.) whose aristæ are unequal; the inner, which is the larger, being furnished with an evident ala; the outer having a narrow margin only: stigmata sharp and spreading: style dilated into an ovate bulb which has an attenuated base.

3. *Salmea? curviflora* (nob.) differs from both the preceding in the tube of its corolla being remarkably bent outwards. In place of the inner arista there is a broad obtuse wing, of which the inner margin is straight and thickened, the outer continued down nearly to the base of the pericarpium: the outer arista is winged:
and

and besides these, one or two minute processes are generally observable. *Stigmata revolute**.

In the 12th edition of *Systema Naturæ*, Linneus added to his genus *Calea* a fourth species, namely *Calea scoparia*; for what reason it would be difficult to discover, as it does not resemble, either

* In the remarkable character of its re-curved florets, as well as in some other respects, this species of *Salmea* agrees with *Spilanthus arboreus* of George Forster (in *Commentat. Gotting. ix. p. 66.*), of which he originally formed his genus *Laxmannia*; from a very erroneous view of its structure, however, having described the Nectarium or glandula epigyna as a "germen superum;" the real, though imperfect, germen with its two aristæ as a "perianthium bidentatum," and consequently referring the genus to *Polygamia segregata*.

When he afterwards corrected these errors and reduced *Laxmannia* to *Spilanthus*, he did not discover that he had only the imperfect hermaphrodite or male plant before him.

That *Spilanthus arboreus* is really dioecious, I have ascertained from the examination of numerous specimens collected by Sir Joseph Banks in the Island of St. Helena, where it forms a small tree called by the inhabitants White-wood. It is *Bidens arborea* and perhaps also *Spilanthus tetrandrus* of Dr. Roxburgh's List of Plants appended to General Beaton's Tracts on St. Helena; the former being probably the female, the latter as varved variety of the male plant.

In re-establishing *Spilanthus arboreus* as a genus, sufficiently distinct from *Bidens*, *Spilanthus*, and *Salmea*, it will not, I conclude, be considered expedient to recur to Forster's name *Laxmannia*, which as far as relates to this plant is connected only with a series of blunders, was abandoned by the author himself, and has since been applied to another genus already generally adopted. It may be distinguished by the following character, and named

PETROBIUM.

Involucrum polyphyllum subduplici serie: exteriore brevior, foliis paucioribus. *Receptaculum* paleaceum, planiusculum. *Flosculi* dioici, tubulosi, 4-fidi: *Masculi*: Antheris exsertis; *Stigmatibus* acutis hispidulis: *Feminei*: *Staminibus* sterilibus; *Stigmatibus* acutis recurvis. *Achenium* v. parallelo compressum v. angulatum; angulis (2-3) aristatis: *aristis* persistentibus, antrorsum denticulatis.

Arbör (Insulæ Stæ Helenæ). Folia *opposita, indivisa*. Panicula *terminalis, brachiata*. *Involucrum oblongum*. Paleæ receptaculi *squamis involucri subsimiles*. Corollulæ *ochroleucæ, tubo arcuato-recurvo (ut capitulum primo intuitu radiatum videatur)*. Mas. Antheris *nigris, basimarginatis, appendice apicis brevissima, acuta*; *loculis vestigio septi longitudinalis instructis*. Fem. *Staminibus sterilibus distinctis, antheris sagittatis cassis*.

in its fructification or habit, any of the three genera of which, as has been shown, *Calea* was originally composed. This fourth species, which he had at first referred to *Chrysocoma**, is now known to be diœcious;—Browne, by whom it was first described and figured, and one of whose specimens I have examined, Linneus, and even Swartz when he published his *Observationes Botanicae*, being acquainted with the male plant only; which, however, all of them considered hermaphrodite: nor is there any reason to doubt that Gærtner's genus *Sergilus* is also the male of this species; although he has ventured to describe the colour of the embryo, deceived, probably, by the size of the imperfect ovarium, and the colour of its inner surface.

Professor Swartz has since given a more satisfactory account of *Calea scoparia*, and has referred it to *Baccharis*†; to which genus as Richard‡ and Jussieu§ have proposed to limit it, namely to the diœcious species of America, it unquestionably belongs. This limitation of *Baccharis* it may, upon the whole, be expedient to adopt; by doing so, however, a name of Dioscorides is applied to a genus of plants found only in the new continent; while, notwithstanding the contrary opinion is expressed by M. de Jussieu||, sufficient distinctions exist between those species of *Baccharis* from which the Linnean character was taken, and *Conyza* when reduced to its original species, *C. squarrosa* and *bifrons*, and a few others since added to the genus: for these differ from *Inula* chiefly in the extreme shortness of their ligulæ.

As no satisfactory character has hitherto been given of *Baccharis*, that will serve to distinguish it, as now limited, from the diœcious *Gnaphalia*, I propose the following.

* Amœn. Acad. v. p. 404. et Syst. Nat. ed. 10. vol. ii. p. 1206.

† Flor. Ind. Occident. iii. p. 1339.

‡ Mich. Flor. Bor-amer. ii. p. 125.

§ Annal. du Mus. d'Hist. Natur. vii. p. 385.

|| l. c.

BACCHARIS.

(Richard) in *Michaux Amer.* ii. p. 125. *Jussieu in Annal. du Mus. d'Hist. Nat.* vii. p. 385. *Molina Ruiz et Pavon Prodr. Flor. Peruv.* 111. *Baccharidis species Linn.*

Involucrum imbricatum. Receptaculum nudum. Flosculi tubulosi, dioici. Masculi: antheris exsertis, basi muticis; stigmatibus appendice acuto hispidulo; pappo subpenicillato. Feminei filiformes; pappo capillari.

Frutices (Americæ æquinoctialis et temperatæ). Folia alterna, raro opposita, in quibusdam minuta vel nulla, ramis tunc foliaceo-alatis. Inflorescentia terminalis rariusve lateralis, corymbosa, nunc fasciculata. Involucri subovati v. oblongi squamæ scmisca-riosæ, margine simplici. Mas. pappo cinereo. Fem. limbo minuto 2-3dentato, staminibus sterilibus nullis: pappo clongato*.

Willdenow, in his edition of *Species Plantarum*, has retained the four Linnean species of *Calea*, and added to them an equal number, not one of which belongs to any of the genera formed by the original species, but to four others equally distinct.

The first of these additional species, taking them in the order in which Willdenow has arranged them, is *Calea aspera*, which he adopted from Jacquin; by whom it is well described and figured, though erroneously referred to *Calea*.

* I have observed another dioecious genus with naked receptacle, capillary pappus, and a habit nearly similar to that of *Baccharis*, of which *Baccharis nereifolia* Linn. is the only published species. It may be named

BRACHYLENA.

Involucrum imbricatum, squamis coriaceis. Receptaculum nudum. Flosculi dioici. Masculi: antheris exsertis, basi bisetis. Feminei angustiores, limbo 5-fido; filamentis sterilibus: stigmatibus linguiformibus imberhibus. Pappus utriusque sexûs pilosus scaber. Arbusculæ vel Frutices (Africæ australis) subtomentosi. Folia alterna integerrima vel dentata. Inflorescentia terminalis, subracemosa. Involucra subovata, brevia: squamis ovatis, textura uniformi.

This, and not (as M. Richard has supposed) the nearly related species of North America, is what Linneus originally intended by his *Bidens nivea*, as appears by the specimen in his Herbarium: by his original reference to Vaillant's "Ceratocephalus foliis cordatis s. triangularibus flore albo*," described from a specimen in Surian's Herbarium; and by his afterwards adding as varieties of his species the two plants from Carolina figured in Hortus Elthamensis.

Calea aspera is abundantly distinct from *Bidens*, and has very little affinity with any of the original species of *Calea*, and least of all with *C. jamaicensis*, from which the character was taken. Since its appearance in Willdenow's work, however, it has been continued in this genus, in most of the recent catalogues of Gardens, as those of Desfontaines, Decandolle, and the second edition of Mr. Aiton's Hortus Kewensis; and Lamarck in his Illustrationes Generum has copied Jacquin's figure of it, apparently as the principal example of the genus *Calea*.

It is certainly now too late to recur to the name of *Amellus*, under which Browne, as I have already attempted to prove, first proposed this plant as a distinct genus; Linneus having soon after given that generic name to two very different plants, to one of which it is still applied; and the real plant of Browne having till now been mistaken, owing in part to his having entirely overlooked the pappus which is deciduous.

Bidens nivea, however, as long ago as 1784 was described by Von Rohr, and published by him in 1792 in the second volume of the Transactions of the Natural History Society of Copenhagen, as a distinct genus, under the name of *Melanthera*: and in 1803 by Richard, in Michaux's Flora Boreali-Americana, where it is called *Melananthera*, and where the two species included by Linneus

* Act. Paris. 1720, p. 327.

in his *Bidens nivea* are for the first time distinguished: and lastly this genus, as named and determined in the work of Michaux, is adopted by Persoon in his Synopsis.

But as both Von Rohr and Richard have given only the natural character of the genus, and the essential character proposed by Persoon is not altogether satisfactory, I have added the following, and adopted the more generally received name of

MELANANTHERA.

(Richard) in Michaux Amer. ii. p. 106. *Melanthera* Von Rohr in Kio-
benh. Naturhist. Selskab. bind. ii. hefte 1. p. 213. Amellus
Browne Jam. 317. *Bidentis* species Linn. *Caleæ* species Jacquin.

Involucrum duplici serie polyphyllum, subæquale. *Receptaculum*
paleaceum, convexum, paleis foliaceis. *Flosculi* tubulosi, uni-
formes, hermaphroditi. *Achenium* turbinatum angulatum ver-
tice depresso. *Pappus* e setis (2—18) scabris, distinctis, deciduis.
Herbæ (Americæ æquinotialis et temperatæ) *pubescentes, scabræ*.
Folia opposita, indivisa v. sublobata. *Capitula terminalia, pe-
dunculis unifloris, elongatis, ternatis, geminisve*. *Involucrum foli-
aceum*. *Receptaculi hemisphærici paleæ foliolis involucri subsi-
miles*. *Corollæ albida*. *Antheræ nigricantes, appendicibus apicis
albidis, basi muticæ; paulo post expansionem corollæ exsertæ, dein
(contractione filamentorum) fauce inclusæ*. *Stigmata appendice
acuto hispidulo, post retractionem tubi antherarum exserta; de-
mum subinclusa**.

Obs. In Von Rohr's natural character of *Melanthera* the Necta-
rium, or glandular body sheathing the base of the style, is intro-
duced,

* In the extensive collection of plants made by my lamented friend Dr. Smith, on the
banks of the Congo, I have observed a Syngenesious genus, which, though belonging to
Polygarnia superflua and having yellow flowers, is in other respects so nearly related to
Melananthera, that had it been found with ripe seeds only, it would certainly have been
referred

duced, which is the earliest notice I have yet found of this organ in Compositæ, except in Batsch's *Analysis Florum*, published in 1790, where it is both described and figured in *Coreopsis tripteris*. The merit, however, of establishing its nearly universal existence in the hermaphrodite florets of this extensive class belongs to M. Cassini.

Both Von Röhr and Richard in their characters of *Melananthera* have described the antheræ as shorter than the corolla, which is indeed the case in a particular state of the flower; immediately after its expansion, however, they project considerably, and again become inclosed in the more advanced stage. This fact has been noticed by Jacquin*, who considers the final inclosure of the antheræ to be owing to the elongation of the corolla. But the actual increase in length of the corolla is very slight, and by no means sufficient to account for the appearance; the real cause of which is a considerable, and I believe a gradual, contraction of the filaments. This œconomy is not unfrequent

referred to. The following characters, however, prove it to be sufficiently distinct. It may be named

LIPOTRICHE,

Involucrum duplici serie imbricatum, subæquale. *Receptaculum* convexum, paleis foliaceis, distinctis. *Capitulum* radiatum. *Ligulæ* (simplici serie) femineæ. *Flosculi* hermaphroditi, *stigmatibus* appendice acuto hispidulo. *Achenia* subuniformia, turbinata; *Pappo* setaceo, caduco.

Herbæ (Africæ æquinoctialis) Folia *opposita*, *indivisa*. Pedunculi *terminales*, *terni*. *Involucra* *brevia*, *foliacea*. Paleæ *receptaculi* *carinatæ*, *nervosæ*, *acutæ*. *Corollulæ* *flavæ*. *Ligulæ* *elongatæ*, *3-dentatæ*. *Antheræ* *nigricantes*, *subinclusæ*, *basi muticæ*. *Achenium* *obtusè tetragonum*. *Pappus*, *in disco verticis depressi*, *brevis*, *e setulis simplici serie*, *numerosis* (8—10), *distinctis*, *denticulatis*, *caducis vel deciduis*.

Melanantheræ proximè accedit: affinis quoque *Ecliptæ* Linn. *Wedeliæ* Jacq. et *Diomedæ* Cassini (in Journ. de Phys. tome lxxxii. p. 145.) sed ab his omnibus satis distincta videtur.

* Collect. ii. p. 291. Ic. Rar. iii. t. 583.

in *Compositæ*, especially in the tribe of *Helianthæ*, to which *Melananthera* belongs.

In M. Cassini's Memoir on the Stamina of *Compositæ* the retraction of antheræ is not expressly noticed. This appearance, however, can hardly have escaped so accurate an observer; and his opinion respecting its cause may perhaps be inferred from an observation he has made on the stamina of the tribe in which it is most remarkable, namely *Helianthæ*; whose filaments below the joint, he says, wither very soon after fœcundation*. To this withering, which he does not mention as occurring in any other tribe, the phænomenon in question may be supposed to be ascribed.

But it appears to me, that the contraction or collapse of the filaments, from their previous state of extension, is a vital action, and not the effect of withering or decay, which, however, speedily follows it. For the contraction may in great part be prevented by the separation of the floret, when the filaments are in the state of extension: and in many genera of *Compositæ* the antheræ are never retracted, but continue to project till they fall off with the corolla.

This contraction is also analogous to the more evident motion or irritability of the filaments long ago noticed by Borelli and Alexander Camerarius† in certain *Cinarocephalæ*; and more fully described in the same tribe by Dal Covolo‡; whose observations are confirmed and extended to other subdivisions of *Compositæ* by Koelreuter§. A similar contraction and

* Journal de Physique, tome lxxviii. p. 276.

† Ephemerid. Acad. Nat. Curios. cent. ix. et x. p. 194.

‡ Discorso della Irritabilita d'alcuni Fiori. Firenze 1764.

§ Von Einigen das Geschlecht der Planzen betreffenden versuchen. 3. fortsez. p. 125.

irritability

irritability of the style has been lately described by Mr. Ker in certain species of *Arctotis**.

The *second* species added to the genus by Willdenow is *Calea lobata*, which Linneus, from the general appearance, I conclude, rather than from actual examination of the plant in Clifford's Herbarium, had referred to *Conyza*; and having no specimen in his own Herbarium, the twofold error of supposing it to belong to *Polygama superflua*, and to have a naked receptacle, remained uncorrected in all his subsequent works.

Its real structure was first pointed out by Professor Swartz, who consequently referred it to *Calea*, with the character of which it exactly agrees. This alteration is adopted in the first edition of *Hortus Kewensis*, where the generic character of *Calea* is modified, to admit those species that are without pappus; and by Gærtner, who limits the genus to *C. lobata* and *C. jamaicensis*, as the only species that correspond with the Linnean character. But as *C. jamaicensis*, the original species of *Calea*, has been shown to have a pappus of a very different kind, it becomes necessary to give a new name to *Calea lobata*; and some additions being also wanting to its generic character, I propose the following, and the name of

NEUROLENA.

Calea Gært.

Involucrum imbricatum, foliaceum. *Receptaculum* paleaceum, planiusculum. *Flosculi* tubulosi, uniformes, hermaphroditi. *Antherae* inclusæ, basi muticæ (emarginatæ). *Stigmata* acuta, recurva. *Pappus* capillaris, denticulatus, persistens.

Frutex (Americæ æquinoctialis) erectus. Folia alterna, indivisa, et lobata. *Corymbus terminalis, compositus*. *Involucra subovati fo-*

* Botanical Register, i. 34.

liola obtusa, nervosa. Palcæ receptaculi involucro subsimiles. Corollulæ flavæ*.

The third species, *Calea pinifolia*, is adopted from Forster's Florulæ Insularum Australium Prodromus.

The specimen of this plant in George Forster's Herbarium (now forming part of the extensive collection of Mr. Lambert) is very imperfect; it evidently, however, belongs to the same species with a more complete specimen received, without a name, from Forster by Sir Joseph Banks, in whose Herbarium I have examined it, and ascertained that it has a naked receptacle. It therefore cannot be a species of *Calea*, which I have no doubt Forster considered it merely from a certain degree of resemblance to his *Calea leptophylla*. From the structure of its stigmata, antheræ, and involucre, *Calea pinifolia* belongs, indeed, to a very different tribe, and might even be referred to *Gnaphalium* as it at present stands. But this extensive and ill defined genus evidently requires reformation;

* There are two other genera in many respects agreeing with the character here given of *Neurolæna*, which it is necessary to point out. The first is *Carphephorus* of M. Cassini (in Bulletin des Sciences 1816, p. 198), sufficiently distinct in having the stigmata of *Eupatorium* or *Liatris* with the habit of the latter, from some species of which it differs only in its receptacle having palcæ. The second, not yet described, may be named

PIPTOCARPHA.

Involucrum imbricatum, turbinatum, scariosum. *Receptaculum*: paleis distinctis. *Flosculi* tubulosi, uniformes, limbo revoluto. *Antheræ* exsertæ, basi bisetæ. *Stigmata* filiformia, acuta, hispidula. *Pappus* pilosus.

Frutex (Brasiliensis) ramosissimus, decumbens? Folia alterna, integerrima, subtus incana. Involucra axilluria et terminalia, fasciculata, glabrata, squamis sessilibus obtusiusculis enerviis, textura uniformi. Paleæ receptaculi squamis intimis involucri subsimiles, et unâ cum iisdem deciduæ. Corollulæ glabræ. Setæ antherarum integerrimæ. Pappus albus, radiis simplici serie.

Obs. I have not seen perfect seeds; and as even in the unripe state they fall off along with the inner squamæ of the involucre, and the antheræ project in a remarkable degree, it is possible the plant here described may be only the male of a diœcious species: it certainly, however, belongs to a genus not before published.

and if the necessity for its subdivision be admitted, it will also, I believe, be found most expedient to apply the name *Gnaphalium* to that section to which *G. luteo-album*, *sylvaticum*, and *uliginosum* belong, and which is characterized by its naked receptacle, its involucrem connivent at top and of equal height with the truncated capitulum, which consists of numerous filiform female florets in the circumference, with a smaller number of hermaphrodite florets in the disk, both of them ripening seeds and having a sessile capillary deciduous pappus.

To *Gnaphalium* so limited *Calea pinifolia*, a shrub with nearly acerose leaves, and in which all or most of the flosculi are hermaphrodite and the radii of the persistent pappus somewhat thickened upwards, cannot be referred.

It seems, however, to approach more nearly to *Antennaria*, a genus separated from *Gnaphalium* by Gærtner, but which, as he has proposed it, consists of three tribes of plants sufficiently dissimilar in habit and structure to justify a further subdivision; and, what is remarkable, none of them entirely agreeing with his generic character.

The first tribe consists of herbaceous plants, natives of Europe and North America, having the male and female flosculi in distinct involucre and on different individuals. To this genus the name ANTENNARIA* may remain, though descriptive of the pappus.

* ANTENNARIA.

Antennariæ species. Gærtner. Gnaphalii species. Linn. Jussieu.

Involucrum imbricatum, scariosum, coloratum. *Receptaculum* epaleatum, scrobiculatum.

Flosculi dioici. *Masculi*: *antheris* basi bisetis: *stigmatibus* truncatis: *Pappo* vel penicillato v. apice incrassato. *Feminei* filiformes, limbo parvo: *staminum* rudimentis nullis: *Pappo* capillari.

Herbæ perennes, tomentosæ, incanæ. *Folia* plaua, adulta sæpe super glabriuscula; *radicalia* in plerisque latiora. *Inflorescentia* corymbosa rarò solitaria. *Involucri* turbinati vel quandoque hemisphaerici squamæ e basi calycina superne coloratæ (albæ v. purpurascetes). *Corollulæ* flavæ. *Antheræ* semiexsertæ. *Pappus* marium niveus, opacus.

Ous.

pappus of the male flower only. Its species are *Gnaphalium dioicum* Linn., *alpinum* L., *carpaticum* Wahlenberg, *plantagineum* L., and *G. margaritaceum* L.

The second tribe, consisting of *Gnaphalium Leontopodium* and

Obs. *Gnaphalium margaritaceum*, which I have referred to this genus, was first described by Clusius; from whose account it appears to have been introduced into the English gardens from America towards the end of the sixteenth century.

It has ever since been very generally cultivated, as an ornamental plant, both in this country and on the continent of Europe; and has a place in several of the European Floras, as well as in those of North America. It is surprising, therefore, that hitherto the male plant only should have been observed, uniformly, however, considered as hermaphrodite, except by M. Cassini, who in his first memoir on *Synantheræ* (in *Journal de Physique*, tome lxxvi. p. 200) suspects it to be male, from the imperfect appearance of the ovarium.

That this species of *Gnaphalium* is really diœcious, I learned several years ago from the inspection of a specimen of the female plant in the Herbarium of Sir Joseph Banks, who found it on the banks of the Rymney in Glamorganshire, where the plant was first observed by Lhwyd. I have since received several specimens of both sexes from Mr. Bichenon, to whom I had mentioned this fact, and who obligingly undertook to observe the different states of the plant in the same place, where it seems to be really indigenous. I have never been able to discover any female florets in the circumference of the capitulum of the male plant; but in the centre of the female capitulum I have always found two or three imperfect male florets, whose antheræ, although cohering and of the usual form, appear to be destitute of pollen.

The separation of sexes in a still more common plant of this class, namely, *Serratula tinctoria*, has been equally overlooked.

All the authors who have noticed this species, which is included in almost every European Flora, as well as in more than one recent Monograph of the genus, have considered it as hermaphrodite, while it really belongs to *Polygamia diœcia*, or has its perfect sexual organs on different plants. The hermaphrodite plant, apparently perfect, but which I believe very seldom ripens seed, is well figured by Schkuhr (in *Botanisches Handbuch*, tab. 234); and the female, whose stigmata are remarkably developed and undulated, while the antheræ are evidently imperfect, and which generally produces ripe seeds, is represented in *English Botany* (tab. 38), in *Flora Danica* (281), and probably also in *Svensk Botanik* (170). For my knowledge of this fact respecting *Serratula tinctoria* I am indebted to the Rev. Robert Bree of Camberwell, who pointed out to me both its states, which he was then disposed to consider as distinct species.

Leontopodioides, which may be called LEONTOPODIUM, is in affinity intermediate between *Antennaria* and *Gnaphalium* as here limited, but has sufficient characters to distinguish it from both.

The third tribe has been found only in South Africa, and consists of shrubs with small rigid beath-like leaves, of which the margins are incurved, the upper surface tomentose, and the under convex and nearly smooth; but by a remarkable twisting they are in most of the species resupinate; a character which seems to have been overlooked in all the described species; namely, *Gnaphalium muricatum*, *mucronatum*, and *scriphioides*. In this tribe, or genus, which may be named METALASIA, the involucre is generally cylindrical, and in most of the species has a short radius formed by the spreading coloured laminæ of the inner scales; the flosculi are few in number, and all hermaphrodite; and the radii of the pappus, which fall off separately, are either thickened or more strongly toothed at top.

Calea pinifolia does not even belong to this genus, though it has a nearly similar habit; but the margins of its leaves are revolute, and their tomentum chiefly on the under surface. In these respects, as well as in the principal characters of fructification, it agrees with several shrubs, chiefly of New Holland and Van Diemen's Island; among which are *Eupatorium ferrugineum*, *Eupatorium rosmarinifolium*, and *Chrysocoma cinerea* of M. Labillardiere. Part of these have the inner squamæ of the involucre simple, as seems to be the case in *Calea pinifolia*; while in others, as the two species referred to *Eupatorium* by M. Labillardiere, they form a short radius. These I am inclined to consider merely sections of one and the same genus, which may be distinguished by the following character, and named

OZOTHAMNUS.

OZOTHAMNUS.

Involucrum imbricatum, scariosum, coloratum. *Receptaculum* epaleatum, glabrum. *Flosculi* (pauciores quam 20) tubulosi, vel omnes hermaphroditi, vel paucissimi feminei angustiores in ambitu. *Antheræ* (inclusæ,) basi bisetæ. *Stigmata* apice obtuso subtruncato hispidulo. *Pappus* sessilis, pilosus, nunc penicillatus, persistens.

Frutices (Novæ Hollandiæ et Novæ Zelandiæ, vix Africa australis,) *graveolentes, tomentosi*. Folia *sparsa, integerrima, marginibus sæpius recurvis*. Inflorescentia *terminalis, corymbosa v. congesta*. Involucra *alba v. cinerea: squamis intimis nunc conformibus et conniventibus; nunc laminis patulis niveis radium brevem obtusum efformantibus*. Corollulæ *luteæ*. *Pappus albus*.

The fourth species added to *Calea* by Willdenow is *Calea leptophylla* of Forster, whose specimens I have examined in Mr. Lambert's Herbarium. Amongst Forster's drawings, formerly referred to, there is a coloured figure of this plant, by which it appears that he originally considered it to belong to *Gnaphalium*. From this genus he afterwards removed it, probably on finding it referred to *Calea* in the collection of Sir Joseph Banks, by whom it was discovered in New Zealand in a more perfect, at least in a more luxuriant state.

This plant, though agreeing with *Calea* in every part of the Linnæan essential character, differs remarkably from it in other points of nearly equal importance, as well as in habit; and along with *Calea aculeata* of M. Labillardiere, and several other species also natives of New Holland and Van Diemen's Island, constitutes a genus very nearly related to *Ozothamnus*, from which it is to be distinguished chiefly by the paleæ of its receptacle.

I propose

I propose to name this genus in honour of *M. Henri Cassini*, whose well conducted investigation of *Compositæ* has already thrown much light on the structure and economy of the more important parts of fructification of this difficult class: and especially of those organs from which the distinguishing characters of *Cassinia* are here derived.

I shall add the characters of the species of this genus, which, like *Ozothamnus*, admits of subdivision into two sections; and I have appended to it *Calea spectabilis* of *Labillardiere*, a plant corresponding with it in character, but differing very much in habit from all the other species.

CASSINIA.

Caleæ sp. *Labillardiere*.

Involucrum imbricatum, scariosum, pauciflorum. *Receptaculum*: paleis distinctis, squamis intimis involucris subsimilibus. *Flosculi* tubulosi, vel omnes hermaphroditi vel paucissimi feminei angustiores in ambitu. *Antheræ* (inclusæ) basi bisetæ. *Stigmata* apice obtuso subtruncato hispidulo. *Pappus* pilosus v. penicillatus, persistens.

Frutices. Folia sparsa, sæpius angustata, marginibus recurvis. Inflorescentia terminalis, corymbosa rariusve paniculata. Involucra alba nunc cinerea ruro aurea; squamis intimis sæpius apice conniventibus, nunc patulis et radium brevem obtusum efformantibus.

† *Involucrum radiatum* (squamis intimis apice patulis).

1. *C. leptophylla*, foliis lineari-lingulatis subter ramulisque incanis, corymbis terminalibus, involucris turbinatis.

Calea leptophylla. *Forst. Prodr. n.* 287. *Willd. Sp. Pl.* iii. p. 1796. *Persoon Syn.* ii. p. 406. *Poiret Encycl. Suppl.* ii. p. 28.

Loc.

Loc. Nat. Novæ Zelandiæ campi arenosi prope Tolaga, &c.
D. Banks. Prope Queen Charlotte's Sound *J. R. et G. Forster.*
 (v. s. in *Herb. Banks et G. Forster.*)

†† *Involucrum connivens.*

A. Fruticose.

2. *C. denticulata*, foliis ovalibus oblongisve acutis spinuloso-denticulatis subter tomentosis, corymbis compositis, involucris hemisphæricis.

Loc. Nat. Novæ Hollandiæ ora orientalis prope Port Jackson.
David Burton. (v. s. in *Herb. Banks.*)

3. *C. longifolia*, foliis lanceolato-linearibus elongatis lævibus subter tomentosis, corymbis decompositis, involucris turbinatis.

Loc. Nat. Novæ Hollandiæ ora orientalis prope Port Jackson;
 in dumetis. (v. v.)

4. *C. aurea*, foliis lanceolato-linearibus elongatis lævibus subter glandulosis, corymbis decompositis, involucris ovalibus: squamis apice aureis.

Loc. Nat. Novæ Hollandiæ ora orientalis prope Port Jackson;
 in sylvis et dumetis. (v. v.)

5. *C. aculeata*, foliis angusto-linearibus margine revolutis super hispidulis subter ramulisque incanis, corymbis compositis decompositisve congestis, involucris turbinatis.

Calea aculeata. *Labill. Nov. Holl. ii. p. 41. t. 185.* *Persoon Syn. ii. p. 406.* *Poiret Encycl. Suppl. ii. p. 28.*

Loc. Nat. Insula Van Diemen; in dumetis et ad ripas fluv.
 (v. v.)

6. *C. affinis*, foliis angustato-linearibus margine revolutis super hispidulis

hispidulis subter concoloribus, corymbis decompositis congestis, involucris turbinatis.

Loc. Nat. Novæ Hollandiæ ora orientalis prope Port Jackson; in dumetis. *D. G. Caley.* (v. s.)

Obs. *C. aculeatæ* nimis affinis.

7. *C. lævis*, foliis angustissime linearibus margine revolutis super lævibus subter ramulisque incano-tomentosis, corymbis compositis, involucris congestis cylindraceis.

Loc. Nat. Novæ Hollandiæ ora australis; in campis ad radices montium prope ortum Spencer's Gulph. (v. v.)

8. *C. arcuata*, foliis angustissime linearibus margine revolutis super lævibus subter ramulisque incano-tomentosis, panicula pyramidata, involucris spicatis cylindraceis arcuatis.

Loc. Nat. Novæ Hollandiæ ora australis; in campis elevatis prope ortum Spencer's Gulph. (v. v.)

9. *C. quinquefaria*, foliis angustissime linearibus super ramulisque glabris, panicula decomposita, involucris turbinatis: squamis 5-fariis.

Loc. Nat. Novæ Hollandiæ ora orientalis prope Port Jackson; in montosis. *D. G. Caley.* (v. s.)

†† B. *Herbacea.*

10. *C. spectabilis*, panicula decomposita, foliis lanceolatis decurrentibus subter ramisque lanatis.

Calea spectabilis. *Labill. Nov. Holl.* ii. p. 42. t. 186. *Persoon Syn.* ii. p. 406. *Poiret Encycl. Suppl.* ii. p. 28.

Loc. Nat. Novæ Hollandiæ ora australis; in sylvis dumetisque prope Memory Cove, Port Lincoln, &c. legi. In Insula Van Diemen a D. Labillardiere detecta. (v. v.)

Since

Since the publication of Willdenow's *Species Plantarum* very few alterations have been made in the genus *Calea*.

In Persoon's *Synopsis* two of the species are excluded; namely, *Calea scoparia*, which, following Swartz, he has referred to *Baccharis*; and *Calea aspera*, adopted from Richard as a species of *Melananthera*. The additional species in the work referred to are *C. cordifolia* of Swartz, already noticed as a genuine *Calea*; *C. aculeata* and *spectabilis* of Labillardiere, which belong to *Cassinia*; and *C. cordata*, adopted from Loureiro, of whose plant nothing is known except from the short description in *Flora Cochinchinensis*, which is only sufficient to render it probable that it neither belongs to *Calea* as I have proposed to limit it, nor to any of the genera hitherto confounded with it.

M. Poiret, in the Supplement to the *Botanical Dictionary of the Encyclopédie Méthodique*, has under the article *Calea* retained all the species of this genus given by Persoon; and also *Calea aspera*; which, however, he has in a subsequent article correctly referred to *Melananthera*.

Connected with the proper subject of this paper, I shall describe and add some observations on a plant lately sent from Brazil by Mr. Sellow; which, though not strictly referable to *Compositæ*, probably belongs to a genus at present included in this family; and conclude with a few remarks on the structure and affinities of *Brunonia*.

I have named the Brazil plant

ACICARPHA SPATHULATA.

Herba annua? glaberrima, ramosa, diffusa. *Rami* adscendentes, angulati. *Folia* sparsa, petiolata, exstipulata, spathulata mucronulo brevissimo, sesquiuncialia, crassiuscula? glauca? sæpiùs integerrima; inferiora quandoque extra medium dentata.

Petioli lineares basi parum dilatata semiamplexicauli; inferiores elongati; superiores plerumque folio aliquoties breviores. *Capitula* solitaria, nunc oppositifolia pedunculata, nunc terminalia subsessilia, basiflora, ovata, flava. *Involucrum* simplici serie pentaphyllum, capitulum floridum superans, foliaceum; foliolis inæqualibus spathulatis sessilibus integerrimis ipsa basi connatis. *Receptaculum* subulato-conicum, paleaceum. *Paleæ* lanceatæ mucronulatæ, inter flosculos hermaphrodito-masculos magis manifestæ, inter hermaphroditos passim abortientes. *Flosculi* tubulosi, uniformes, glabri.

Flosculi ambitus, duplici triplicive serie, hermaphroditi, utroque organo perfecto. *Corollæ Tubus* gracilis cylindræus, cum ovario continuus, hasique stylo accretus, per lentem 10-striatus. *Limbus* infundibuliformis, 5-fidus, æstivatione valvata; laciniis semilanceolatis, planis, trinerviis; nervis lateralibus margine parallelo-approximatis, indivisis, apice confluentibus, e nervis alternis tubi infra sinus furcatis ortum ducentibus.

Stamina 5 epipetala, limbi laciniis alternantia.

Filamenta inferne cum tubo arcte connata, superne libera, fauci quasi inserta, invicem cohærentia in tubulum 5-dentatum, ipsis apicibus, subito mutatione texturæ, articulatis; basi intus incrassatum arcis 5 oblongis cum filamentorum axibus alternantibus.

Antheræ continuæ, lineares, dimidio inferiore arcte cohærentes, superiore liberæ; biloculares, loculis longitudinaliter dehiscens, valvula interiore angustiore, receptaculo pollinis utriusque loculi longitudinali septiformi: basi emarginatæ, lobulis posticis acutiusculis brevibus polliniferis; apice simplices connectivo ultra loculos haud producto. *Pollen* subglobosum, per lentem pluries augmentem obsolete angulatum.

Ovaria connata, singula coronata calyce 5-fido dentibus spinescentibus cum laciniis limbi corollæ alternantibus; monosperma, ovulo

ovulo ovato pendulo, paulo infra apicem affixo funiculo crassiusculo ex ipso apice angustato cavitatis orto; chorda vasculari a puncto insertionis ad extremitatem inferiorem ejusdem lateris attingenti. *Stylus* filiformis glaber, inferne cum basi tubi corollæ connatus. *Stigma* simplex obtusum hispidulum.

Flosculi superiores numerosi hermaphrodito-masculi, paulo minores hermaphroditis, calycis laciniis submembranaceis; ovariis (pariter connatis) imperfectis, sæpius absque ovulo.

Pericarpia (flosculorum ambitûs): *Achenia* conferruminata, singula coronata calyce aucto 5-spinoso, spinis patulis conico-subulatis e substantia suberosa axi solidiori rigida.

Semen pendulum, ovatum extremitate superiore acuminato: *testa* membranacea: *membrana propria* nucleo adhærens. *Albumen* figura seminis, carnosum, copiosum, album. *Embryo* axilis, subcylindraceus, longitudine fere albuminis, albus, dicotyledoneus. *Cotyledones* lineares, obtusæ, plano-convexæ, vix longitudine *Radiculæ* cylindraceæ, superæ.

Notwithstanding the great difference between my account of this plant and that given by M. de Jussieu of his *Acicarpa tribuloides*, I have very little doubt that they both belong to the same genus; though from the above description it is evident that *Acicarpa spathulata* is not referable to *Compositæ*. To this plant *Calycera* of Cavanilles, in the seeds of which M. Correa has found albumen, seems to be very nearly related; and a third genus, probably referable to this group, is *Boopis*, described by M. de Jussieu in the same Memoir with *Acicarpa*. The important characters, however, of the pendulous ovulum and inverted embryo remain to be ascertained in all these; and the presence of albumen in *Acicarpa tribuloides* (in *Acicarpa lanata* of Lagasca in Pers. Syn. ii. p. 488, if it really belong to this genus), and

in both species of *Boopis*. Another question respecting the latter genus is, whether its capitulum be simple, as it certainly is in *Acicarpa spathulata*; or compound, as Jussieu's figure of *Boopis anthemoides* seems to indicate.

In the mean time, with the necessary knowledge of structure of *Acicarpa spathulata* only, I shall venture to propose this group as a distinct natural family to be placed between *Compositæ* and *Dipsacæ*; though upon the whole somewhat more nearly approaching to *Compositæ*. This family, if my conjectures respecting *Calycera* and *Boopis* should be hereafter verified, may be called *CALYCERÆ*; *Acicarpa* even as a generic name being barely tenable, provided the original species agrees with that here described: for on this supposition M. de Jussieu has mistaken the lacinix of the perianthium for paleæ of the receptacle, deriving the name of the genus from their form; and has entirely overlooked the real paleæ, which, though they could not have suggested this name, may however sanction its being retained, if it be not still better to change it to *Acicarpa*.

It will be attended with similar advantage to form a separate family of

BRUNONIA,

as a link of equal importance, connecting *Compositæ* with *Goodenoviæ*, but from both of which it is in many respects very distinct. As I have formerly described this genus, and made several observations on its principal affinities*, I shall here only state the more important relations and distinctions between it and those families to which it appears to me most nearly to approach.

Brunonia agrees with *Goodenoviæ* in the remarkable indusium of the stigma; in the structure and connexion of the antheræ; in

* Prodr. Flor. Nov. Holl. p. 589.

the seed being erect ; and essentially in the æstivation of corolla. It differs from them in having both calyx and corolla distinct from the ovarium ; in the disposition of vessels in the corolla ; in the filaments being jointed at top ; in the seed being without albumen ; and in its remarkable inflorescence, compatible, indeed, with the nature of the irregularity in the corolla of *Goodenoviæ*, but which can hardly coexist with that characterizing *Lobeliaceæ**.

With *Compositæ* it agrees essentially in inflorescence ; in the æstivation of corolla ; in the remarkable joint or change of texture in the apex of its filaments ; and in the structure of the ovarium and seed. It differs from them in having *ovarium liberum* or *superum* ; in the want of a glandular disk ; in the immediately hypogynous insertion of the filaments ; in the indusium of the stigma ; and in the vascular structure of the corolla, whose tube has five nerves only, and these continued through the axes of the laciniaë, either terminating simply (as is at least frequently the case in *Brunonia sericea*), or (as in *B. australis*) dividing at top into two recurrent branches forming lateral nerves, at first sight resembling those of *Compositæ*, but which hardly reach to the base of the laciniaë.

It is a curious circumstance that *Brunonia* should so completely differ from *Compositæ* in the disposition of vessels of the corolla, while both orders agree in the no less remarkable structure of the jointed filament ; a character which had been observed in a very few *Compositæ* † only before the publication of M. Cassini's second Dissertation, where it is proved to be nearly universal in the order.

In the opposite parietes of the ovarium of *Brunonia* two nerves or vascular cords are observable, which are continued into the style, where they become approximated and parallel. This struc-

* See Flinders's Voyage to Terra Australis, ii. p. 559.

† Batsch Anal. Flor. p. 107 ; et Schkuhr Handb. tab. 236 et 244.

ture,

ture, so nearly resembling that of *Compositæ*, seems to strengthen the analogical argument in favour of the hypothesis advanced in the present paper—of the compound nature of the pistillum in that order, and of its type in phænogamous plants generally;—*Brunonia* having an obvious and near affinity to *Goodenoviæ*, in the greater part of whose genera the ovarium has actually two cells with one or an indefinite number of ovula in each; while in a few genera of the same order, as *Dampiera*, *Diaspasis*, and certain species of *Scævola*, it is equally reduced to one cell and a single ovulum.

Sir James Smith, in establishing *Brunonia* as a genus, is disposed to refer it to *Dipsacæ*. To certain species of this order it, indeed, bears a striking resemblance in habit; it also very nearly agrees with them in its remarkable inflorescence; and one great objection to its union with them may be supposed to be removed in adopting M. Decandolle's account of their ovarium.

But as *Brunonia* differs from the whole order in the following characters, all of which are of primary importance;—namely, in the origin and æstivation of corolla; in the insertion and whole structure of stamina; in the indusium of the stigma; in the ovulum being inserted at the base of the cavity of the ovarium; in the erect embryo and want of albumen;—I continue to think that its proper place in the natural method is between *Goodenoviæ* and *Compositæ*.

I shall conclude this subject, by proposing a few queries respecting the indusium of *Brunonia* and *Goodenoviæ*.

Is this remarkable covering of the stigma in these families merely a process of the apex of the style? or is it a part of distinct origin, though intimately cohering with the pistillum? On the latter supposition, may it not be considered as analogous to the glandular disk surrounding or crowning the ovarium in many other

other families? And, in adopting the hypothesis I have formerly advanced* respecting the nature of this disk in certain families,—namely, that it is composed of a series of modified stamina,—has not the part in question a considerable resemblance in apparent origin and division to the stamina of the nearly-related family *Stylideæ*?

To render this supposition somewhat less paradoxical, let the comparison be made especially between the indusium of *Brunonia* and the imperfect antheræ in the female flowers of *Forstera*. Lastly, connected with this view, it becomes of importance to ascertain whether the stamina in *Stylideæ* are opposite to the segments of calyx or of corolla. The latter disposition would be in favour of the hypothesis. This, however, is a point which will not be very easily determined, the stamina being lateral. In the mean time, the existence and division of the *corona faucis* in *Stylidium* render it not altogether improbable that they are opposite to the segments of the corolla.

Since the preceding paper was submitted to the Society, M. Cassini has published † the substance of a Memoir, which he read to the Academy of Sciences of Paris in August last, on a new family of plants named by him BOOPIDEÆ, and consisting of *Calycera*, *Boopis*, and *Acicarpha*. I have also, through the liberality of Messrs. de Jussieu, Desfontaines, and Baron Delessert, had the opportunity of examining specimens of *Acicarpha tribuloides* in flower and fruit, of both species of *Boopis* in flower, and detached flowers and pericarpia of *Calycera*. In all of these I have found the ovulum pendulous; and in *Acicarpha* and *Calycera* an inverted embryo occupying the axis of a fleshy albumen.

* Linn. Soc. Transact. x. p. 159.

† Bulletin des Sciences, 1816. p. 160.

My

My conjectures, therefore, on their structure and relation to *Aci-carpa spathulata* of the preceding paper, are completely verified by this examination, as well as by the observations of M. Cassini, who with his usual acuteness has detected the principal characters distinguishing *Boopideæ* from *Compositæ* and *Dipsacææ*, between which he has also placed them.

As M. Cassini's Memoir, though read subsequently to mine, is already published, the name *Calycereæ*, which I have proposed for this family, is superseded by that which he has given it.

But as his account of the order is by no means complete, several characters of considerable, though not primary, importance being entirely omitted, I may be allowed to add to my paper some remarks on the more essential points of resemblance and difference between it and the two families to which it is most nearly related.

The principal characters distinguishing *Boopideæ* from the whole of *Compositæ* are the pendulous ovulum and the albumen inclosing the embryo, of which the radicle points to the apex of the pericarpium. It appears to me necessary to state all these characters, and nearly in the terms in which they are here given: for, 1st, A pendulous ovulum most frequently, indeed, is not, however, invariably connected with *radicula supera*, though that direction of radicle might here, as well as in *Compositæ*, with confidence have been inferred from the vascular structure of the ovulum*. 2dly, Where the insertion of the ovulum is, as in this family, evidently below the upper extremity, the radicle which

* Some of the indications in many cases afforded by the structure of the unimpregnated ovulum, of the position and direction of the parts of the future embryo, have hitherto been overlooked: the subject, however, for its elucidation requires details incompatible with the limits of the present communication. I have in another place (*Flinders's Voyage to Terra Australis*, ii. p. 601.) thrown out a similar hint, which has probably attracted no attention, and must reserve the explanation of both for a separate essay.

points to this extremity cannot in strict propriety be described as directed towards the umbilicus. M. Cassini has not noticed the direction of the radicle; either from supposing it constantly connected with that of the ovulum, or, which is more probable, from not having ascertained it.

These distinctive characters may be considered as fully sufficient to authorize the separation of *Boopideæ* from *Compositæ*; yet the same differences exist between certain genera referred and really belonging to *Rubiaceæ* and the principal part of that order.

There are, however, three other characters unnoticed by M. Cassini, which distinguish the flowers of *Boopideæ* from the hermaphrodite flowers of the whole of *Compositæ*; namely, the accretion of the base of the style with the tube of the corolla; the absence of the epigynous disk or nectarium; and the longitudinal subdivision of each cell of the anthera by a "receptaculum pollinis," as in most other families, and of which, indeed, there seems to be the rudiment in the syngenesious genus *Petrobium*, described in the preceding paper.

In the partial cohesion of the antheræ, in which they resemble *Jasione*, they certainly differ from all known *Compositæ*: but as in certain *Compositæ* the antheræ are very slightly connected or entirely distinct;—this, though a remarkable circumstance, can hardly be employed as a distinguishing character.

The principal characters in which *Boopideæ* differ from the greater part, though not from the whole of *Compositæ*, are the corolla being continuous, or not jointed, with the ovarium; the antheræ having no membranaceous appendix at top; and the undivided stigma.

Boopideæ differ from *Dipsaceæ* in the vascular structure and valvular æstivation of corolla; in the æstivation, insertion, and con-

nexion of antheræ; in the absence of the partial involucre; and in having alternate leaves.

In adopting M. Decandolle's description of *Dipsacæ**, they would differ also in the important character of "ovarium inferum." This distinction, however, is neither universal, nor I believe absolute in any case.

M. Auguste Saint Hilaire in his excellent Memoir on *Primulacæ* †, while he admits the correctness of M. Decandolle's account with respect to great part of *Dipsacæ*, has at the same time well observed, that in several species of *Scabiosa* the ovarium is entirely united with the tube of the calyx. But neither of these authors has remarked the curious, and I believe peculiar, circumstance, of the base of the style cohering with the narrow apex of the tube of the calyx, even in those species of the order in which the dilated part of the tube is entirely distinct from the ovarium.

This kind of partial cohesion between pistillum and calyx is directly opposite to what usually takes place, namely, the base of the ovarium being coherent, while its upper part is distinct. It equally, however, determines the apparent origin or insertion of corolla and stamina, producing the unexpected combination of "flos superus" with "ovarium liberum."

In the vascular structure of the corolla *Boopideæ* may be considered as essentially agreeing with *Compositæ*, in many of whose genera the middle nerves of the tube and segments are equally manifest. In stating the character derived from this source in either of these orders, it is not sufficient to describe the nerves of the lacinia only as M. Mirbel has done in his character of *Compositæ* ‡, and M. Cassini in that of *Boopideæ*: but it is also neces-

* Flor. Franc. 3^{me} ed. vol. iv. p. 221. † Mem. du Mus. d'Hist. Natur. ii. p. 47.

‡ Elemens de Physiol. Veget. et de Botan. ii. p. 885.

sary to give their disposition in the tube or undivided part of the limb; there being instances in both families where the lateral nerves of the segments do not unite at top; and, as has been formerly remarked, several examples in other families of a nearly similar disposition in the segments, accompanied by a different disposition in the tube. To the examples of this kind formerly given, *Globularia cordifolia* may be added, in the segments of whose lower lip there are three simple nerves, of which the lateral do not unite at top, and continue distinct nearly to the base of the tube, where they converge and appear to unite with the middle nerve.

In *Acicarpa* and *Boopis* the filaments appear to me jointed as in *Compositæ*; a character I have not been able to observe in the very few flowers which I have examined of *Calycera*.

In *Acicarpa* the florets of the circumference are hermaphrodite and apparently complete, the antheræ containing pollen and the ovaria producing seed; while those of the disk are male with an incomplete pistillum. Such an arrangement has not hitherto been observed in *Compositæ*, in which, wherever the central florets are male with an imperfect pistillum, those of the circumference are female with or without the rudiments of stamina.

The regularity in the order of expansion of flowers from the base to the top of the capitulum in *Acicarpa tribuloides* and *spathulata*, and the irregularity, approaching to the inverted order, which I have found to exist in both species of *Boopis*, seem to prove the capitulum to be simple in the former genus and compound in the latter, notwithstanding the great resemblance between their involucre. The exact nature of its composition, however, in *Boopis* can only be satisfactorily determined in recent specimens.

This irregular expansion in *Boopis*, which renders even the generic name improper, and at present the want of satisfactory characters to distinguish it from *Calycera*, are objections to the name M. Cassini has chosen for this family; while that of *Calycereæ*, which I have proposed, derived from the genus first described, and applicable to all the genera of the order, appears to me unexceptionable: especially as there seems no reason to doubt that the part which I have considered as calyx in *Boopideæ* is really such; its divisions being generally in equal number, and alternating with those of the corolla. It may be observed that a like alternation of the divisions of the pappus with the segments of the corolla obtains in those genera of *Compositæ* where both parts are in equal number. But in some cases, where the division of pappus is still further reduced, the same alternation does not exist, especially in those genera having vertically compressed pericarpia and two aristæ, as *Spilanthus* and *Salnea*.

The absence of "discus epigynus" in *Boopideæ* is a necessary consequence of the accretion of the base of the style with the tube of the corolla. It seems to me, however, that a modification of the same organ may be traced in the five thickened areolæ observable within and near the base of the tube formed by the filaments in *Acicarpa spathulata*; and much more distinctly in the same situation in *Boopis balsamitifolia*, where they have the appearance of five adnate fleshy bodies alternating with the filaments.

This apparent decomposition of the glandular disk in *Boopideæ*, compared with its state in *Compositæ*, as well as its transposition and the alternation of its parts with the stamina, seem to give some additional support to the conjecture I have formerly hazarded in the paper on *Proteaceæ*, published in the Society's Transactions (vol. x. p. 159); namely, that in several families—for the
hypothesis

hypothesis not meant to be extended to all—this part, even in its simplest state, may be considered as formed of a series of modified stamina: Or, merely to state the facts from which the conjecture originates, that there are certain families in some of whose genera this organ exists in its simplest form, that of an undivided fleshy ring; while in other genera of the same families it consists of several distinct bodies alternating with the stamina, and in some cases putting on the appearance of barren filaments.

This hypothesis is chiefly applicable to families in which the number of stamina is equal to the divisions of one floral envelope only, the nectarium being supposed to be formed of the second series: but it receives its principal support from *Scitamineæ**, where the glandular bodies belong actually to the same series with the perfect stamen.

I am aware at the same time of several objections to its generalization. Thus, the nectarium or glandular disk exists in families where, though the stamina are definite, they are equal in number to the divisions of calyx and corolla united; and moreover, in such families where it consists of distinct parts, these parts are placed where an addition to the number of stamina is least likely to take place, as in *Crassulaceæ*. Here, however, as in many other cases, the divisions of the disk are opposite to the ovaria; they may therefore be supposed more intimately connected with the pistilla than with the stamina; an opinion which I believe held, though not yet published, by the ingenious M. Decandolle with respect to *Ranunculaceæ*. In support of this opinion it may be noticed that in *Pæonia Moutan*, where the disk or urceolus is in the state of the greatest development, when a multiplication of the pistilla takes place, which in the double-flowered varieties of this

* See Flinders's Voyage to Terra Australis, ii. p. 574.

species

species it not unfrequently does by the addition of one or more inner series, the rudiments of an analogous disk are produced along with each of the additional series.

Yet, in opposition to this view, I have in a single instance found one of the divisions of the urceolus in *Pæonia Moutan* changed into an anthera; and the divisions of the apparently analogous organ in *Aquilegia*, which in their usual state resemble barren filaments, have sometimes been observed with perfect antheræ*.

* Schkuhr Handbuch, tab. 146.